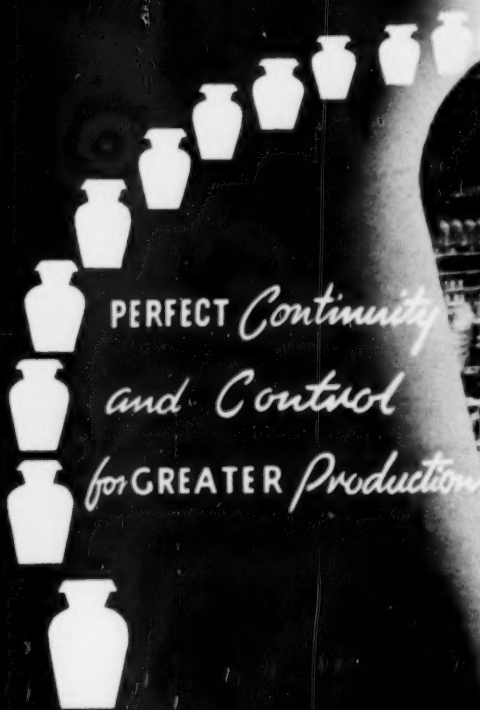


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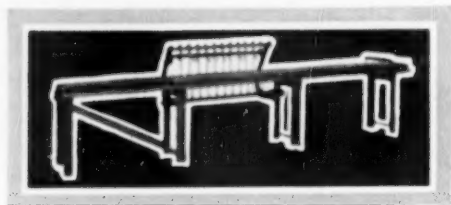
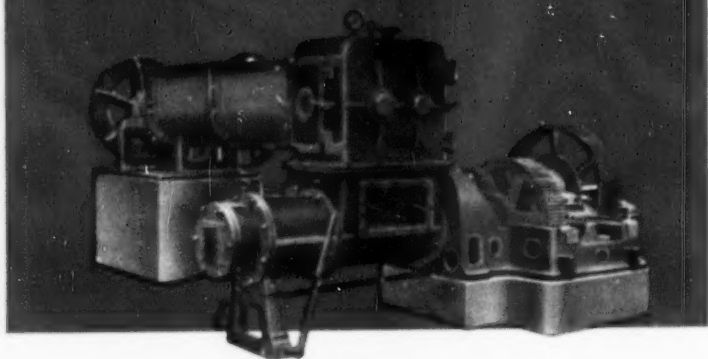


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Tile ribbons are extruded from the auger and are cut to required lengths by either a power or hand-operated cutting table, such as the type T.M.G. shown in the lower illustration.

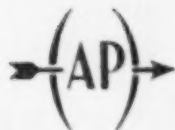


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VOL. II

APRIL, 1950

NO. 14

Materials of Construction

BRITISH CERAMIC SOCIETY JUBILEE

A GLANCE at the papers to be read at the forthcoming conference organised by the Society of Chemical Industry and detailed on another page should cause Ceramists to take pride in their importance. "Materials of Construction for the Chemical Industry" covers an immense potential field, yet, ceramics occupies practically three of the six sessions of the conference and eighteen out of the thirty-five papers!

Such industries as aluminium can muster but one paper—even rubber and plastics take only five, whilst the ferrous metals including cast iron and stainless steel account for only five. It is when ceramic materials are outlined by comparison with the others that the true versatility and tremendous importance of the industry is realised.

The week following this conference comes the Jubilee Celebrations of the British Ceramic Society. No organisation has done more to improve the status of the industry. We extend to the Society our best wishes for its continued expansion, our congratulations to its Honorary General Secretary (some say he *is* the Society) and our desire to supplement the work of the Society in helping to disseminate technical knowledge in that which is one of the largest single industries in Britain.

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Men and Management

Production and Politics

• by Argus •

THERE is no doubt that Mr. Cuthbert Bailey in his recent address to the British Pottery Managers' Association under the title "Joint Industrial Management" did well in trying to differentiate between ideologies and realities.

On the question of management it is symptomatic of our era that slogans have come into being which in themselves are merely a conglomerate of words with punctuation marks. "Full employment," "The class struggle," "Capitalist domination" are some examples which spring to mind—they are meaningless as such, but by suggestion and implications, they can mean almost anything.

Recently I glanced again at *Capital* by Karl Marx, published in the middle of the Victorian reign. One sentence does much to summarise his opinion of capitalism—"We have seen that the continual tendency and law of development of capitalist production is to separate the means of production (the workshop and its tools) more and more from labour and to concentrate the scattered means of production more and more in large groups, thereby transforming labour into wage labour and the means of production into capital."

That was his finding nearly 100 years ago. Yet one finds there is a tremendous gulf between the humble miner and the Coal Board Chairman in spite of socialism!

"Class Struggle"

Because of the ruthlessness of a large number of Victorian employers, the employees in their own interest joined together and formed the Trade Unions. Their original aims were straightforward—an improvement of

working conditions and an improvement in wages. They realised that the strike weapon, by preventing employers' expensive machinery from turning enabled the workers to demand a greater proportion of the factory income. In turn the strikers lost wages, suffered persecution and in that particular economic era the phrase "the class struggle" was fairly straightforward in comprehension.

"Master" and "Man"

The Victorian employers' approach was just as simple—he had to buy raw materials and employ labour and was actuated by the simple, if untrue, belief that the lower the wages he paid the greater would be his profit.

Further more, in those days, Britain was in the heyday of small private enterprise and "master" and "man" were fairly concise classes.

However, the decades rolled by with changes to both management and men. The small factories amalgamated one with the other to produce the combines. Simultaneously the smaller Unions combined with one another to produce the large amalgamated Unions we know today. This had its repercussions again upon management and men. In the first place, the master as such disappeared, and in his place were appointed what may be described as professional managers, often with no shareholding or only a nominal shareholding in the business. If it were a family business, the shares were held by the family—if the son had ability and a desire to work in the business, then he did so, but in the event of the son having neither ability nor the desire to work, then he became an absentee shareholder or director and

a professional manager did the job on a salary basis.

Likewise the Trades Unions altered in shape and formation.

Change in Unions

Originally they were craft Unions and jealously guarded the number of entrants into a particular craft. But with the evolution of the machine and the rapid growth of semi-skilled and unskilled labour, the craft aspect of the Unions gradually disappeared and they really became protection Societies with the simple proposition of getting increased wages or resisting proposed wages decreases and simultaneously improving working conditions. The background was really to get more pay for less work for the harder they worked the more the "boss" exploited them. That was the story! Pride of work and pride of craft tended to be considered as disloyalty to their mates.

The old class struggle of employer and employee changed to a larger conflict between what may be described as federations of employers and federations of unions. That counterpart of the class struggle reached its peak with the General Strike of 1926 and the tremendous number of industrial disputes, strikes, and lockouts which marked the unhappy progress of the 1920s and 1930s.

The Labour Party

However, the political scene was likewise changing. In the 19th Century politics was a gentlemanly battle between Liberals and Tories, the basis of which was that the Tories were protecting the interests of the decaying landed aristocracy, whilst the Liberals were finding a place in the sun for the rapidly rising industrialists. But Duchess married the Textile King, and their daughter married an Earl which made commerce a respectable occupation. Yet the turn of the century saw a new political party—the Labour Party—launched and in this the social reformers, the Fabians and the intellectual idealists who opposed the prevailing capitalist system joined forces with the Trade Unions, who also opposed the same capitalist system. What is so often overlooked is that the former was an ideological opposition to capitalism by the

patronising professional classes but with the Unions it was a bitter struggle for a living wage!

Thus again into the British political system was introduced politics with a sectional interest. In this lay the new 20th Century interpretation of the class struggle.

Now it was that slogans—and the most important slogan "nationalisation"—came to the forefront.

Nationalisation

Let us be honest with ourselves—by nationalisation, the man at the bench was encouraged to expect either more wages for the same amount of work or larger wages for less work. But the yardstick of measurement of the amount of work was never considered. In broad terms, it had been preached that if the profit-mongers were eradicated or if their fruits were distributed to the workers, then the latter's standard of living would increase considerably—in short there would be more pay for less work!

What had been forgotten was that World War II did two things. It increased the productivity of heavy industry which was moribund between wars, and simultaneously it pegged by the Excess Profit tax the profit earnings from industry. Thus in 1945 industry was producing a prodigious output compared with pre-war, but the real tax-free earnings of industry to the shareholders, directors and so on was lowered proportionately and likewise was the industrial life blood profits which could be ploughed back. Yet in spite of income-tax and so on, the workers in general (but not the armed forces) were drawing a greater proportionate income from their own increase in productivity. The process of soaking the rich to distribute to the poor had begun.

The class struggle as was once interpreted, had undergone another change. The owners and their minions in the form of middle-class and professional managers, were relatively less well off in relation to production than they were pre-war. The workers were much better off on the same basis of comparison than they were pre-war. That is much the position now as it was in 1945 and reflects the way votes were cast in the 1950 election.

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Wages and Productivity

Unfortunately, the Labour Party was pledged to the Trade Union movement to give better wages and better working conditions without any consideration of productivity. Now the former find it necessary for the first time to say that increased wages can only come through increased productivity. The manual worker in industry therefore feels that he has been let down badly and if there is an industrial trade recession he might in extreme cases turn to the Communist Party, which as yet has not been tried in office. Its promises of the millennium simulate the promises which were made by the Labour Party before they had accepted majority office and executive responsibility.

All in all, it would appear that we were endeavouring to achieve the impossible. We were trying to give to the many the supposed fruits that were once held by the few. But by the time the apple had been cut into millions of portions, only the air-bubble between the cells was left.

Human Nature Has Not Changed

Mr. Cuthbert Bailey was hitting upon a most important part of the thorny question of industrial relations when he talked about Joint Industrial Councils. The Carpenter of Nazareth when he preached human brotherhood was preaching an ideal; but this ideal has not been realised as yet, and indeed no outstanding approach to its acceptance has appeared in 2,000 years! We are very little changed from the Romans, who threw people to the lions. In fact perhaps we are a little worse—for we throw atom bombs at the people!

Surely it is apparent to those who care to think in simple terms that men were not born equal. Equally hypocrisy has proved itself to be always the best-seller in human relations. Tell a man what he wants to believe and you are 90 per cent. towards hypocritical success. Many lacking thought wish to believe they are good, that they work hard, that they are exploited, that somebody else is reaping the advantages of their work and that they are badly treated by the world. This excuses the able from working harder and it excuses the disabled (in the wider sense) for their incapacity.

Unfortunately it does not encourage the best results from the community in general.

You can improve a man's environment, but you cannot interfere with inherited traits and characteristics—and the U.S.S.R., in one of the greatest experiments in human relations, have proved fairly conclusively and against their will, that inherited traits play more than a 50 per cent. share in our make-up as compared with environment. And we, poor fools can but interfere with the latter.

We are still as we were 2,000 years ago; we are each different, we each have different desires and inclinations and our ideas of success or failure are different. As yet we have not approached any unanimity in arbitrating between success or failure.

Scientific method and scientific thought when applied presupposes that you have some axioms upon which you can develop a hypothesis. In human relations we have none.

Thus anybody's thoughts or anybody's ideals are as good as the next man's, be he dustman or duke, for each can now enter the democratised House of Lords.

A Joint Industrial Council or some place where everyone can get together and discuss the problems of industrial life, seems desirable, but unfortunately we are all individuals, and it means finding a yardstick of measurement of success or failure. He who shouts loudest, he who promises that which is most coveted by the many, is bound to court apparent success—but having risen to power by such means he must be prepared for his throat cut when he fails to deliver the goods!

Hypocrisy in Politics

In condemnation of capitalism, the early Socialists railed against profit. Now they glorify the 4½d. made recently by the Coal Board! They pointed with scorn to the class privilege of the landed gentry, the absentee director, the unscrupulous landlord and the discrimination in income between worker and owner. In fifty years, conditions have improved largely by the process of evolution, but it is just as possible today when the same people who railed have reached position of authority, to point out that relatively similar injustices

and discrepancies exist.

In the House of Lords one sees the successful Trade Unionist who has risen on the backs of his fellows. In the nationalised industries again, the Trades Union leaders have found well-paid executive posts—and dictate to their once fellow workers. The teacher has been promoted to a Minister. Yet the wage discrepancies between he who works with his hands and he who does not, still prevails.

We hear hypocritical denunciations of the workers' right to strike by the same people who actively encouraged them to do so 20 or 30 years ago! We see the armed forces used to break strikes by a Government whose members denounced the Opposition for just such an action. We see large sums spent on the armed services by the same people who denounced far too little similar expenditure by the Opposition in the years before the war.

It is not a question of agreeing or disagreeing with any of the above measures, but it does confirm a latent hypocrisy in all political castes in their efforts to achieve power.

The fault today is that the last effort which receives any encouragement or reward is industrial service. There is a constant sapping from the manual occupation trades. Popular education has done much to exaggerate the importance of the white-collar professions (so called) and the school boy, if he wishes to interest himself in mines and mining, flies to the offices of the Coal Board—never to the pit face!

Aristocracy of Labour

This drain on the number of people entering the production ranks of industry will play its toll in the years to come. This inherited snob value that a clerk should be paid more than a miner or a dustman will convert us into a nation of shopkeepers with nothing to sell!

The aristocracy of labour is our sole salvation, but it is not to be achieved by ideological motives such as Joint Industrial Councils. It is certainly not to be achieved by wage freezing. It is certainly not to be achieved by the mere doling out of social services in a manner which unrelates them to productive effort

and gives the slacker and the worker equal benefits.

If it is right and proper that in the interests of the nation, promotion in the army and the other armed services should be through the ranks, then surely, since we depend upon industry for our national livelihood, promotion in civil life should come in a similar manner.

Facing Realities

Would it be too bad if an executive in the mining industry began in the mines? Or a trained engineer began in the workshop? Or a medical officer of health in the Scavenging Department of a local authority? There are too many snobs in the professions who revolt from the smell of earth, the removal of their coats and dirt in their finger nails. Only by ensuring that everyone at least in some stage of his career has been brought face to face with the stark realities of production can this snob complex be broken. But break it we must, else fewer and fewer will produce and productive labour will become even more so the conglomerate of the least able people in the community, when of course it must be the very scene of our national life which is highly attractive to the most able!

Viewers heard Honor Croombe the other night say that leisure and recreation were the tools of the brain worker! But are all pen pushers brain workers and all miners and pottery workers brainless?

Business is a sacred trust. Its object is to serve the community. Before the war it placed profits above service and nearly destroyed our economic life. By so doing it opened the way for Socialism. But just as pre-war business could not carry the burden of the share pusher and the absentee director, so modern business cannot carry the drone-like bureaucrat.

The factories, the mines, the shipyards and so on must become the test house for civil promotion. What is more, industry must offer attraction for the best of all the different types of humans. Only by successful British Industrial Enterprise can we afford full social services, cultural development and a happy and prosperous Britain.

British Pottery Managers' and Officials' Association

Pottery (Health & Welfare) Special Regulations, 1950

*by***V. B. JONES***H.M. Inspector of Factories*

THIS does not set out to be a comprehensive talk on the new Regulations, but I want to deal primarily with those matters which are different from the existing Regulations. It is not for me to deal with the history of the Regulations, for that would require an evening to itself, but it was over six years ago that the former National Council for the Pottery Industry discussed and recommended certain changes in the old Regulations, in view of the rapidly changing conditions in the industry and the desire to improve working conditions. These proposals were submitted to the Chief Inspector of Factories and form the basis of the new Regulations. Although there have been many valuable suggestions made by various employers and by the National Society of Pottery Workers the real credit for the new Regulations must go to Miss Crundwell who was District Inspector of Factories in Stoke until November, 1948. They were re-drafted and amended in many particulars before they finally appeared as draft Regulations. There were still certain matters which could not be resolved by discussion and a public enquiry was held in October, 1949, and further amendments recommended.

More Straightforward

The new Regulations are much more straightforward than the existing Regulations, and from 2nd April they

will replace both the Pottery Regulations, 1913, and the Pottery (Silicosis) Regulations of 1932. Conditions are very much different even in the worst factories of today from what they were 40 years ago. We start with all factories using a low solubility of leadless glaze, with china factories using alumina, with almost all factories using slop flint, with no flint being used in the incidental processes such as polishing. All these are big changes in themselves. We do not find wedging of clay, or young boys clay carrying, or stoves so hot and damp that water streams down the walls and windows of the potters' shops, or aerographers, ground layers, gilders, transferrers and other decorators working in the same department or even at the same bench.

There is, however, still too large a difference in working conditions between the best run factories and those which are not so well run, and that is why some of the Regulations which deal with matters which are largely but not entirely of the past, are still included.

There are quite a number of matters in the existing Regulations which are not continued in the new Regulations, mainly small points, but I would mention two of the major ones here: there will no longer be any special restrictions on the hours of employment of lead workers, and there will be no legal requirement to supply milk.

The numbers of the Regulations have been inserted for convenience of reference:—

Talk given to Pottery Managers' and Officials' Association on 20th March, 1950.

Reg. 3: Application of the Regulations, for ordinary purposes, particularly in Stoke the application is very similar, all potteries, litho transfer works, potters' mills, etc., are included but the definition of pottery is somewhat wider. Pottery now includes any articles made from clay or a mixture containing clay. Bricks and roofing tiles are still exempt.

Reg. 6: Carrying.

Reg. 6 (2): This prohibits women or young persons carrying clay or clay scraps except clay scraps made by themselves, or by the maker for whom they are working if the total weight is less than 40 lb., and the distance carried is less than 50 yards.

Reg. 6 (6): It was formerly illegal for a woman to move a saggars at all. Now the maximum weight of a saggars for a woman to carry is 30 lb. This may be increased to 50 lb. if the saggars is moved not more than six feet on about the same level. Saggars may not be stacked more than 4 ft. 6 in. from the floor.

Reg. 6 (7): A young person should not be employed to lift or carry any weight exceeding 20 lb., unless there is a certificate from the appointed factory doctor in the health register specifying the maximum weight which he may carry. This Regulation is very much simpler; it also overrides Regulation 6 (2).

Reg. 9. Protective Clothing: This is now required to be provided for potters as set out in the schedule to the Regulations in addition to the lead workers as previously required. Briefly this requires:—

1. Washable overalls for flint millers, sliphouse workers, glaze makers, clay dust workers, clay carriers, casters, earthenware towers, dust tile pressers and fettlers, all other fettlers, biscuit placers, biscuit warehouse workers, lead workers, persons sweeping or cleaning or emptying dust collectors.

2. Washable aprons are required for throwers, jiggerers, jolliers, etc., persons doing damp fettling and other processes in potters' shops.

3. Impervious aprons and bibs for casters, fettlers, earthenware towing, dust tile fettling and low solubility and leadless dipping house workers.

4. Washable head coverings for

persons in dusty processes and lead processes.

Washable overalls or impervious aprons may be provided instead of washable aprons.

Protective Clothing

In view of the difficulties today it is interesting to read in the Annual Report of the Chief Inspector of Factories for 1913 that one of the troubles then was the difficulty in obtaining suitable protective clothing.

Suitable accommodation for protective clothing, separate from outdoor clothing, should be provided. Cupboards in or near shops or in a separate room are recommended, but not in the messroom.

There will be daily cleaning of such overalls, usually by knocking; this should be done outside or if necessary in a cabinet under exhaust but on no account inside the shop.

Reg. 10. Obligation of persons employed to wear the clothing provided and to use the clothing accommodation and to sponge down waterproof aprons.

Reg. 11. Outdoor Clothing: This is also covered by the Factories Act, 1937; it should be preferably near to the place of work.

Reg. 12. Washing Facilities: Similar to the present requirements for lead workers except that only five minutes are allowed for washing time instead of ten. Washing facilities for other workers are covered by the Factories Act.

Reg. 13. Messrooms: Canteens or messroom accommodation should be not only for lead workers but also for potters staying on the factory mid-day.

Reg. 14. Food, Drink and Tobacco: No food, etc., to be taken into any lead process, but it may now be taken into dust tile shops and towing shops for the ten minute intervals. Prohibition on any person remaining in a potter's shop or where clay dust is prepared or in a flint mill during the mid-day interval.

Reg. 15. Ventilation: Similar to present Regulations. All drying should be in a stove where practicable. The ventilation of the stoves should be so as to prevent hot air flowing from the stoves into the workroom. We are concerned at the number of new stoves

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which are not properly ventilated.

Ventilation of shops. The new Regulations do not specify hopper windows.

Reg. 16. Temperatures: No more wet bulb thermometers. The maximum should be 75° F. dry bulb instead of 70° F. wet bulb. Temperature when drawing an oven should be not more than 115° F. at head height.

Reg. 17. Exhaust Draught: Not so much different from old Regulations.

Reg. 17 (1) (i): Mouth of flint calcining kiln.

Reg. 17 (1) (vi): Handling of dry flint or clay dust unless damp.

Reg. 17 (1) (vii): Fettling other than damp fettling. Fettling of cast ware is undoubtedly the most serious dust producing job still done without exhaust ventilation. I suggest a downward exhaust through a grid in the bench so that the worker does the fettling over the grid. A hood, except for small fettling, would be difficult. If you can fix a worker more closely to the work by sitting instead of standing do so, and where possible arrange the work so that it can either be done sitting or standing.

Reg. 17 (1) (viii): Damp fettling: No exhaust is required for damp fettling if the scraps are prevented from falling on to the floor; for example handle cutting could be more cleanly done.

Reg. 17 (1) (ix): Dust tile. Stock boxes in addition to the press and for fettling.

Reg. 17 (1) (x): Brushing of earthenware biscuit.

Reg. 17 (1) (xi)-(xv): China biscuit placing and brushing processes using alumina.

Reg. 17 (1) (xvi): Spraying of engobe or slip which contains flint.

Reg. 17 (1) (xvii): Ware Cleaning: Previously only required for full lead glazes.

Reg. 17 (2): Hoods required if practicable.

Reg. 17 (6): Dust should be collected and filtered air not returned to the workroom. Collecting not required for biscuit brushing, ware cleaning, ground laying, polishing, sorting, grinding of tiles, but the air must be discharged to the outside.

Reg. 17 (8): Exhaust apparatus to be tested. A new requirement. Simple form of test with a U tube so that the

water gauge reading may be noted as near the point of the hood as you can get it, is suggested.

Reg. 18. Floors: In potters' shops they should be impervious, easily swept and capable of being washed. Any existing wooden floor may be continued for five years, if in good condition.

Reg. 18 (3) (d): Night sweeping as at present but in addition if the floor is impervious weekly washing or mopping. An alternative to the nightly sweeping and weekly washing is that the floor may be cleaned daily by means of a suitable vacuum cleaner. The regulation does not specify that the filtered air must go outside, therefore a portable plant may be used for this.

Reg. 18 (3) (e): All clay scraps including those under benches and stillages to be removed daily.

Reg. 18 (3) (f): All clay scraps should be removed during the mid-day interval from those parts of the floors of potters' shops on which persons are liable to tread.

Reg. 18 (5): Under the old Regulations this only applied to full lead factories, but now a low solubility dipping house should have an impervious floor.

Reg. 18 (7): Washing and cleaning of floors to be done by adult males.

Reg. 18 (9): Stillages should be arranged so as not to interfere with cleaning. I suggest benches constructed without so many supports.

Reg. 18 (10): Other workrooms to be cleaned daily.

Reg. 19: Work Benches to be sponged down; this should include casters troughs.

Reg. 21 (a): Suitable trucks for the conveyance of dry clay. This should not be carried by hand or on the head or shoulder.

Reg. 21 (d): No shovelling of clay dust after seven years.

Reg. 21 (e): Suitable trucks should be provided for conveying clay dust. This should not be conveyed by hand or on the head or shoulder. Respirators to be provided for persons carrying or handling clay or clay dust.

Reg. 22: Tile Presses: Spacing is laid down.

Reg. 22 (a): The control handle of the tile press should be at bench level.

Reg. 26. Hydrofluoric Acid: In

view of the few serious and the many not so serious accidents those precautions which were recommended by the National Council have been included in the new Regulations. A cautionary notice is being prepared by the Department.

Reg. 28. Separation of Processes: This is not so rigid for modern layouts.

Reg. 28 (3): The sliphouse should be separate from the clay dust processes.

Reg. 31. Works Yards: There has

been a lot done as regards the paving, and concreting of works yards during the last few years. The surface should be maintained in good repair.

Reg. 32. Works Inspector: A suitable person, preferably not the manager, should be appointed to see that the Regulations are carried out. This is similar to the present Regulation, but it is an important matter; the right type of works inspector can improve the general conditions in a works very considerably.

DISCUSSION

Dealing with points raised in discussion, Mr. Jones said that an approved respirator had not yet been officially decided on. The view of his department for many years, however, had been that the only efficient dust respirator was a type known as the Mark IV. At the moment, he was not able to say whether the Mark IV would be the only respirator approved, or whether it would be replaced by another type. It was possible that a cheaper and lighter respirator might be approved, but the Mark IV was generally accepted as the most efficient type.

Issue of Sectional Placards

Asked why the new regulations contained no proviso for affixing and displaying the requirements, Mr. Jones said that this was covered by the general Factories Act Regulations. The new Regulations were required to be posted up in the usual way. A suggestion had been made that the 1950 Regulations might be issued in pamphlet form, and an abstract might be published in due course. He was not sure, however, whether the Regulations would be issued in sectional placards, applicable to various departments. If such sectional placards encouraged workpeople to study the Regulations, it was an idea worth pressing. Otherwise, he thought the practice might be discontinued.

Overtime

On the matter of overtime, Mr. Jones said the position in that respect of girls and young persons remained unaltered. The point was covered, as

in the case of all factories, by the general Factories Act.

In regard to the provision that "no person, during the meal interval, shall be allowed to remain in the potter's shop," Mr. Jones was asked: "Does that mean they shall go out into the street if there is no alternative accommodation?" He replied: "That Regulation means there must be alternative accommodation. Regulation 13 (1) states: 'There shall be maintained for all persons employed in potters' shops a suitable mess-room, furnished with suitable chairs, and provided with heat and warm water.' That provision must be made for potters and lead workers in their mid-day meal break."

Vacuum Plant

Asked if he could supply the names of manufacturers of vacuum plant of which his department approved, Mr. Jones said: "There are many firms manufacturing vacuum cleaners, and a list can be made available. We should like to see fixed vacuum plant, with the air going outside, but it comes down to a question of £ s. d. If you are going to have portable plant, the air is coming back into the room. Even after filtering the coarser stuff the smaller dust particles get back into the workroom, and this is what we do not want people to breathe. On balance, however, we think that the portable vacuum is better than nothing. No one, of course, is going to suggest that for the three-monthly or fourteen-monthly cleaning of fixtures and roofs fixed vacuum plant should be put in, as presumably there would not be many people about to breathe dust on

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those occasions. For floor cleaning, however, there is nothing to prevent vacuum cleaning during the day. When more research has been done—and a little has been done already—to tell us what dust is left in the air by portable vacuum cleaning, we may revise our opinions on this matter.

Employment of Juniors

A further question to Mr. Jones was: Under the Regulations, no person under 18 years of age may be employed in a lead process. What is the position of a young lad working as a ground-layer?

He replied: "That Regulation applies to young persons in the full lead process. The complete prohibition is placed on anyone under 18 in the processes specified. If there are any special difficulties or peculiar cases we should like to know of them. In certain special circumstances, power is given to the Chief Inspector to allow exemption by special certificate."

Replying to a member who suggested that sandpapering and towing had been omitted from the new Regulations, Mr. Jones said that these points were adequately covered in Article 3.

A written question read: "We should be pleased to know of a laundry which can do our extra washing. We cannot get our present laundry returned in under fourteen days, so what are we going to do after 2nd April?"

Protective Clothing

"How, also, is it suggested that all protective clothing required can be secured before the new Regulations become operative?"

Mr. Jones said the difficulties in these matters were fully appreciated by his department. Firms must do the best they could. Because things were difficult, it was no excuse for doing nothing. A great many firms had orders in for protective clothing, and some firms had the whole thing already cut and dried. He thought that with discussions with the workpeople some working arrangement could be made.

As regards the laundry question, he had no practical suggestion to offer. Whatever it might be, it was quite obvious that some extension of the

present laundry arrangements would have to be made. He imagined the matter was under discussion by the Pottery Manufacturers' Federation, and he would be interested to hear the outcome.

Enforcement of Regulations

Other questions asked of the speaker were:—

1. As regards the Regulation about drying clay-ware by stove, the normal practice in sanitary earthenware is to dry ware in an open room by stove at night. Is that still permissible?

2. Does the vacuum cleaning of floors eliminate the process of wet or mop washing?

3. Is it an obligation on the employee as well as the employer to carry out the new regulations; if so, are there powers of enforcement against both of them?

Mr. Jones: Quite a lot of sanitary earthenware is dried in stoves, as against the open stillage method, and that Regulation was put in to encourage the use of stoves, wherever practicable. It means there should be some proper means of ventilation. Just as much moisture comes from ware in stillages as when it is in a stove. There is no intention that open-stillage drying shall be discontinued, however. It aims at getting rid of haphazard stillage drying.

As regards floor cleaning, the intention is not that vacuum cleaning shall be an alternative of wet washing. It is nightly sweeping, coupled with washing or mopping, and daily cleaning with efficient vacuum apparatus. The reason is obvious. No one doubts that damp cleaning is not adequate.

On the point of enforcement of the Regulations, the answer is "yes". There is a general Regulation on "suppression of dust" which lays it down that the duty of every employee is to co-operate in the carrying out of this regulation, and to report any defective plant or machinery where he may find it. Under the old Regulations, every person is under obligation to use appliances for safety and health, and not to misuse appliances provided for his safety, health and welfare. That fairly widely covers the matter, and there have been quite a number of

(Continued on page 68.)

DUCTING SHEET METAL WORK

FOR THE POTTERY INDUSTRY

BY

STEWARTS (HANLEY) LTD
NEW STREET, HANLEY

PHONES

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"POTTERY MANAGERS' CHARTER"

THE eventual aim of the British Pottery Managers' and Officials' Association to evolve a "Pottery Managers' Charter" was revealed in the report of the General Secretary (Mr. F. A. Timmins), presented at the annual meeting of the Association in Hanley.

Mr. Timmins told the meeting:

"It is the ultimate intention, firstly, to contact members and potential members with the object of making this Association's views on management within the industry more widely known and understood, with the eventual aim of evolving a Pottery Managers' Charter."

Reviewing the past year, Mr. Timmins said in July the Executive Committee considered the situation that had arisen as a result of the alleged statement made by the Pottery Workers' Society to the committee on productivity of the T.U.C. As a result, a meeting on the subject took place between the General Secretary of the Society and the Executive Committee. The results of this meeting, said Mr. Timmins, were satisfactory.

Mr. Timmins also referred to a meeting of the Executive Committee in Sep-

tember, when the Business Manager (Mr. J. S. Adams) reported on the Association's meeting with the Wages Advisory Committee of the British Pottery Manufacturers' Federation. Members were advised of the successful conclusion to establishment of a basic minimum salary for administrative staffs.

Mr. Timmins stated that the General Secretary of the Institution of Works Managers was received by the Executive Committee at their last meeting, when the aims of the I.W.M. were explained.

The new President of the Association is Mr. S. E. Glover, joint works manager of George L. Ashworth Brothers Ltd., Hanley. The president-elect is Mr. H. Hulse.

Other officers elected were: Business Manager, Mr. J. S. Adams; Auditors, Messrs. T. A. Pimlott and A. Handley; Librarian, Mr. F. W. Mills; General Secretary, Mr. F. A. Timmins.

The meeting approved an addition to the rules, whereby persons deemed to be working in a senior administrative capacity, on attaining the age of 25 would be admitted to full Association membership.

CERAMICS

POTTERY REGULATIONS.—(Continued from page 66.)

cases taken against workpeople for eating and smoking in lead processes.

A further question was: "We make our own saggars by hand. Is a saggarmaker's shop a potter's shop within the Regulations?"

Mr. Jones: "It is rather a border line case, but I think strictly it is included. Once it is done on a pottery, I think saggars and all other things are included in the Regulations."

The Questioner: "I do not think certain of the Regulations apply if the makers grind and mix their own saggarmarl."

Mr. Jones: "There are obviously a lot of Regulations which do not apply, but I should say that in the past we have not treated saggarmakers' shops as potters' shops. They have been treated as coarse ware, and coarse ware is not referred to in the new Regulations. I do not see, however, why saggarmaking shops should not be cleaned every night, and also have impervious floors."

Questions asked by other members were:—

1. As tile manufacturers, we put our tiles in stillages, and the temperature is maintained slightly higher than in the rest of the factory. Does that come within the scope of drying rooms?

2. As regards the inspection and ventilation of vacuum cleaning plant, is it satisfactory if the works staff carry out that inspection by water gauge or ammeter?

Mr. Jones: "On point 1 I say 'yes'. I say 'stove' includes 'room'. You have got to get rid of the moisture somewhere, and that needs some ventilation. The Regulations are reasonable in that way. Any place where things are dried and are separated in that sense is a drying-room. The answer to point 2 is also 'yes', providing the person or persons are competent in vacuum inspection."

A vote of thanks to Mr. Jones was proposed by Mr. J. S. Adams, and seconded by Mr. E. Lindop.

ELLIOTT OPTICAL PYROMETERS

THE Elliott optical pyrometer is well known in the pottery trade, where it is



Elliott pyrometer for measurement of furnace and kiln temperatures

used for the measurement of furnace and kiln temperatures. Hitherto, the standard instrument has been supplied with two ranges, viz. 800°—1,400° C. and 1,000°—2,200° C. It is recognised, however, that in the pottery industry no very high temperatures are encountered, but a common requirement is the measurement of temperatures in the region of 1,200° C. to 1,300° C., and it is therefore desirable to have an even greater "overlap" between the instrument ranges. A new Elliott instrument is therefore available as an alternative to the previous one. This has the same low range, i.e. 800°—1,400° C., but the high range is from 1,000° to 1,700° C., which gives a more open scale and enables the operator to work conveniently near the centre of the scale.

The Elliott optical pyrometer is of the disappearing filament type and enables accurate readings of temperatures above 800° C. to be obtained easily, quickly and with very little practice. It may be supplied as an entirely self-contained instrument with a "dry" accumulator in the handle, or a separate nickel-iron battery in a portable case.

Full details are available in Publication G.113A, obtainable from the manufacturers, Elliott Brothers (London) Ltd., Century Works, Lewisham, London, S.E.13.

New Refractories and Insulating Materials

by

E. A. K. PATRICK

B.Sc., A.R.I.C., A.M.Inst. Gas E., A.M.I. Chem.E.

IT is the object of this paper to give some account of our experiences in the last few years in the use of new refractory materials. They represent our efforts to provide satisfactory solutions to fresh problems of temperature and working conditions in a wide variety of applications, but when

they are collected together they constitute an addition to the more traditional materials which is becoming invaluable to us, and it is hoped that by setting them forth in this short paper the experience which we have gained will be of help to others.

It is probably true to say that the

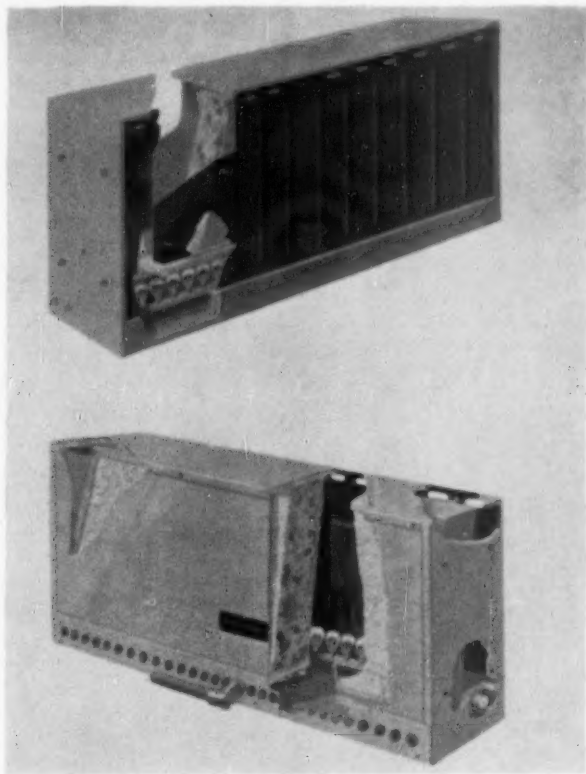


Fig. 1

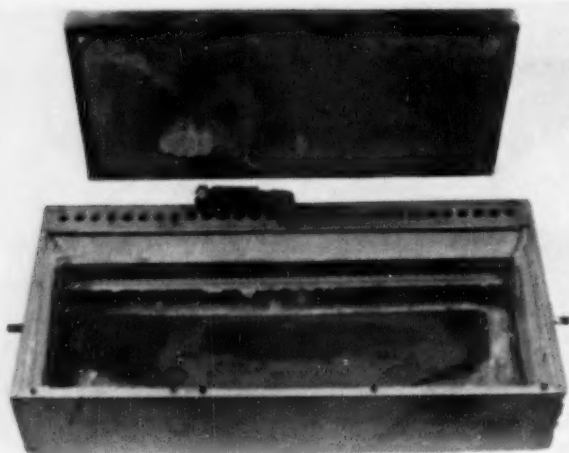


Fig. 2

new materials and techniques to be discussed were all brought into service by the present trend, in one form or another, towards higher working temperatures. To take one example, the jet engine and gas turbine have engendered considerable activity in the field of high temperature metallurgy and thus, also, a need for furnaces at higher temperatures for heat treatments. Powder metallurgy, again, is a new and expanding field involving temperatures upward of 1,600° C., and into which the industrial gas engineer must enter sooner or later.

The Up-grading of Mild Steel

In a paper devoted to the problems of dealing with increased temperatures it seems proper to start at the lowest point on the temperature scale. This is represented for us by the black emitter industrial radiant heating panel (Fig. 1) in which a black mild steel sheet is heated to a temperature not exceeding 650° F. by products of combustion rising from a bar burner in a space bounded by the steel plate and by suitable insulation.

In order to shield the lower part of the plate from excessive heat and thus

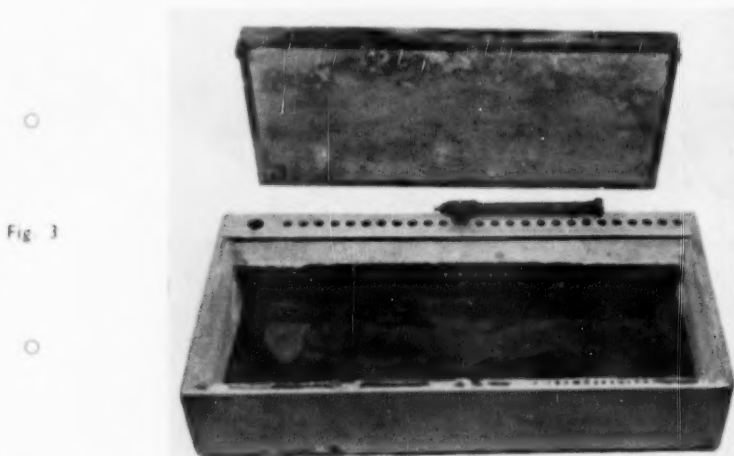


Fig. 3

to maintain it at a uniform temperature, a baffle plate is fitted behind it (see Fig. 2) and it is the temperature reached by this baffle plate which has in the past, been the limiting factor in respect of the permissible working temperature of the emitting plate. If the baffle plate is made of mild steel, then it cannot be allowed to work for any length of time at above 500° C. (932° F.) and this, in turn, has meant that the radiating surface temperature has had to be limited to 650° F.

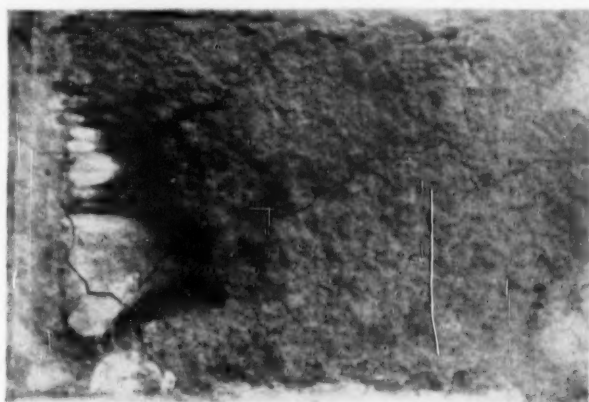
A remedy for this would seem to be the application of a coating of a new refractory enamel which was initially developed for use on mild steel aeroplane exhaust manifolds. This enamel which is similar to vitreous enamel and is applied in a similar manner,

that this represents the maximum temperature which this material will stand.

Low Temperature Insulation

As has already been mentioned, the radiant heating panels are provided with insulation. Here the need is for a slab, some 2 in. thick, of a light insulating material, easy to cut, and able to withstand about 700° C. (1,300° F.), it being remembered that the panels are sometimes used portably, which means that the insulating material must retain a certain degree of mechanical strength, especially as regards the hot surface, after it has seen some service. Normal asbestos, magnesia, or diatomaceous earth slab materials weaken too much at the hot

Fig. 4



can be had in a variety of different forms depending on the service required. For example, the baffle plate of the radiant heating panel (Fig. 2) has a highly refractory, rough coating designed to give maximum protection, whereas the radiating panel has a smoother, more decorative coat (not visible in the illustration) designed to give protection to the surface without impairing its high emissivity. By this means the maximum working temperature of the panel has been raised from 650° F. to 850° F., at which temperature the baffle plate is at about 620° C. (1,150° F.); the plate shown in Fig. 2 has operated for 1,700 hours under these conditions and may be compared with the untreated plate in Fig. 3 which has had an identical working life. It should be made clear that there is no reason to believe

surface, which crumbles, with resultant blockage of burners and combustion space. The effect of any general weakening is most evident when the panels are used sloping forward.

The most satisfactory materials we have yet found are the usual type of soft slab material but with a thin hard surface skin. This surface skin, although it does crack in use, retains its mechanical strength well, with the result that slabs to which it has been applied can be used with confidence to bridge larger unsupported spans than has hitherto been possible.

Fig. 4 shows such a slab 2 ft. x 3 ft. after use horizontally for 1,200 hours under the conditions given above, i.e. at a maximum temperature of the order of 700° F., being unsupported over an area 30 in. x 22 in.

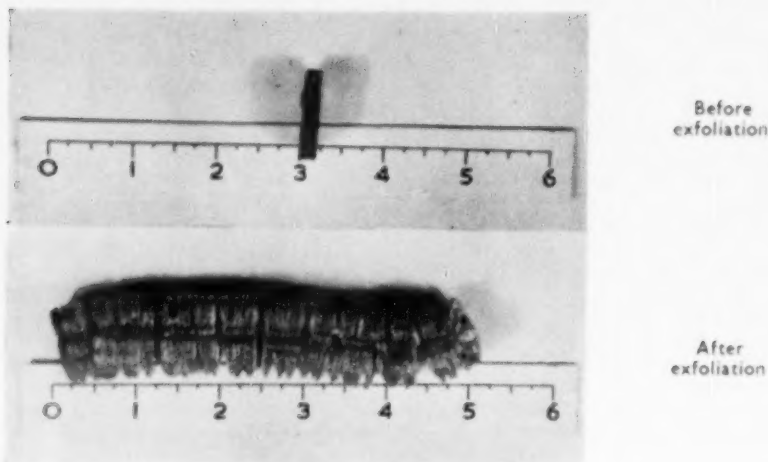


Fig. 5

Insulation up to 1,000° C.

In this class I would like to draw attention to the use of exfoliated vermiculite¹. Vermiculite is a form of mica in which water is present in such a way that when the vermiculite is heated and the water driven out, the planar structure of the mica is expanded so that it increases twenty or thirty-fold in one direction only, becoming a series of leaves containing air spaces between them (See Fig. 5).

Once exfoliation has taken place the material is quite stable and can be used up to 1,000° C. and this stability, coupled with the presence of a large number of air spaces, makes the exfoliated material very suitable for use as a thermal insulator.

It is obtainable either as loose granular material which can be poured into annular jackets surrounding equipment, or in the form of lightweight blocks (Fig. 6) of low bulk density which can be easily cut to shape. We have found, in the course of some development work, that these blocks are not disintegrated by a steamy atmosphere.

High Temperature Materials

In the world of refractories there is a barrier at about 1,200°-1,250° C., to cross which involves forsaking the fireclay refractories which are the mainstay of furnace construction. Instances in which this barrier has to

be crossed are becoming more frequent and one such application is the subject of a companion paper to the present one.

The upper limit of developments which can directly be foreseen at the present time is somewhere in the region of 1,950°-2,000° C., where gas may hope to enter the sintering and powder metallurgy field and it is proposed to discuss some of the materials which may be found suitable for use in the temperature range 1,250°-1,950° C.

Aluminous Insulating Refractories

For temperatures up to 1,550° C. it is usual to turn to the class of material known as aluminous refractory. This is of itself not new. We have, however, had to combine it with another technique which is becoming standard practice—the use of hot face insulation—and this combination is not achieved as easily as might be expected.

Fireclay insulating refractories are well established and we are accustomed to take their bulk density as a rough measure of their thermal conductivity. Vicissitudes which are described in the companion paper already referred to have, however, made it plain that at the higher temperatures at which the aluminous bricks have to work, matters are not so simple, since, with the greater preponderance of radia-

tion at high temperatures, pore size becomes an important factor and an average pore size of about 1 mm. appears to be desirable for work in the 1,000°-1,500° C. range now under consideration.

Silicon Ester Bonding

This development is based on the properties of an organic chemical compound, ethyl silicate. This substance may be kept in a solution in alcohol but is decomposed by water to give, ultimately, silica. When this occurs, the solution, a pale straw-coloured liquid, hardens to a gel. If this is heated, volatile constituents, mainly alcohol, are driven off followed at higher temperatures by water leaving behind a deposit of silica. In practice other materials known as condensing agents, are added to give control of setting.

In use, the solution of ethyl silicate is mixed with a mixture of alcohol and water, the greater the proportion of water, the shorter the setting time, and to this mixture may be added a suitable refractory powder giving a cold set which is strong enough to handle. A convenient setting time is 15 to 20 minutes, which gives time for the mixture to be vibrated into a greased wooden mould.

An alternative method is to mix

alcohol and water with the ester solution before sale, with just sufficient water to bring about gelation. This mixture is kept in sealed containers and upon mixing with a refractory powder picks up sufficient moisture—about 3 per cent.—to induce a quick set. This, of course, relies on this refractory powder being sufficiently hygroscopic and has the disadvantage that the mixture as sold has a limited shelf life of a few months.

Initial heat treatment drives off the residual alcohol and care has to be taken to prevent this from igniting, since this would result in the deposition of carbon, which is harmful to the strength of the material. Once this stage has been passed, heat may be freely applied and at some temperature in the region of 1,200° C., the silica fluxes and forms a glassy matrix which has considerable strength.

Disadvantages at present are the limited shelf life of the silicon ester solution and the necessity for measuring out with reasonable accuracy the alcohol and water which have to be used.

The new material has been put to two principal uses. The first is the casting process already referred to, which can be applied to quite intricate shapes with good reproducibility.

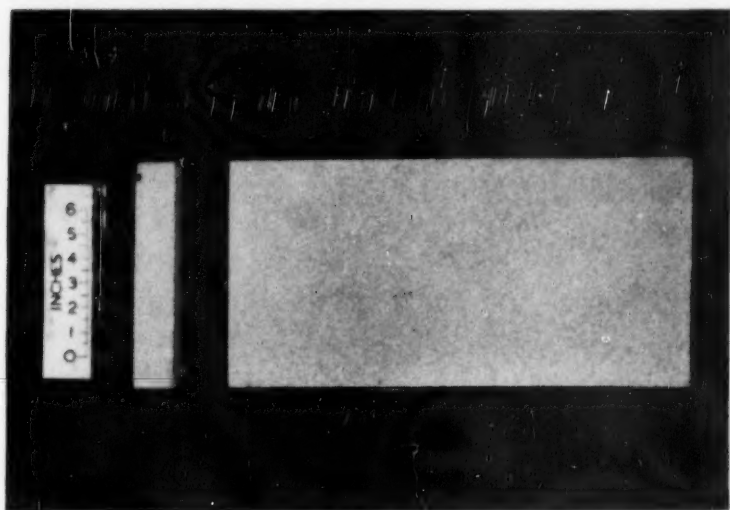


Fig. 6

CERAMICS

For example, Fig. 7 shows size 60 Hypact burners cast in two materials, sillimanite and zircon⁶.

The second use is in the facing of hot-face insulating refractory bricks. The motives behind the use of insulation on hot faces are powerful but solid refractories have often to be retained in combustion chambers, etc., because the softer insulating refractories cannot withstand the erosive action of the flames and hot gases. Fig. 8 shows some experimental pieces treated with different mixes. It should be noted that it is possible to use the silicon ester without any refractory filler for surface hardening, although the best results obtained so far have included some filler. Naturally the usefulness of this idea is greatest when applied to the high temperature aluminous insulating refractories. If the application proves successful it should be possible to construct furnaces entirely of suitable insulating materials and then apply a protective wash, with a brush, to the internal surfaces. Such a furnace would then have the minimum heat capacity and weight, with all the concomitant advantages.

In addition to the applications described above, which may fairly be classed as recent advances and on which we have done some experi-

mental work with encouraging results, there are a number of other ideas on which work is commencing, or it is hoped will commence shortly.

Muffle Linings

Among these is the problem of muffle linings able to withstand both thermal shock and high temperatures and, in this direction, samples are being collected in a variety of materials—silicon carbide, sillimanite fused alumina, mullite and zircon. Mullite pieces of this size are a new development but we have been using mullite pyrometer sheaths up to 1,500° C. with success. Much work has been done recently on the use of zircon in refractories^{6,7} and tests on the zircon muffle are awaited with interest.

A sample of fused magnesia brick, very dense and claimed to be able to withstand 1,950° C., has been obtained but there has not as yet been any opportunity to try it.

The logical goal in the production of standard furnaces would seem to be the use of a thin-walled lining about $\frac{1}{4}$ in. thick cast possibly in silicon ester-bonded zircon or sillimanite, placed in a box and backed with a granular insulating material poured in before the outer case is sealed. The excellent resistance to

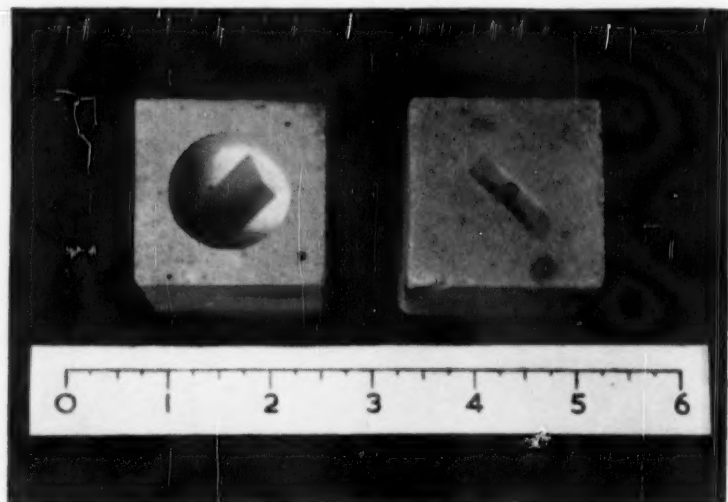
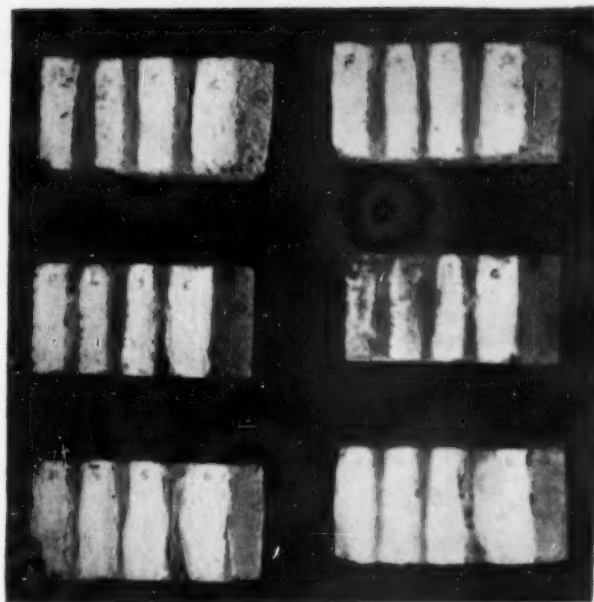


Fig. 7

Fireclay insulating
refractoryAluminous
insulating
refractoryDiatomaceous
insulating
brick

Before firing

After firing.

Fig. 8

thermal shock claimed for silicon ester-bonded materials gives hope that quite complex mouldings would prove satisfactory in this respect. Such a furnace would be the cheapest possible to construct. Granular insulation might be exfoliated vermiculite or magnesite powder. It is proposed to construct an experimental furnace on these lines as soon as possible.

Conclusion

The principal limitations under which the designer of industrial heating equipment labours are frequently those set by available materials of construction. The work of development therefore entails a perpetual search for new materials. A number of new materials are now making their appearance, and it is to be hoped that the gas industry and the manufacturers of these materials will together make it their business to exploit the potentialities of them to the full in order to provide industry with equipment able to operate serenely under conditions of ever increasing severity and of course, always with economy of fuel and capital.

Thanks are due to the North Thames Gas Board for permission to prepare and present this paper.

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Presented to the London and Southern Junior Gas Association, 1st March, 1950.

Henry Wiggin and Co. Ltd.—We have received an interesting booklet entitled "Monel, Nickel and Inconel. Uses in the Process Industries." This booklet is arranged in alphabetical order of the various industries and suggestions are made for the use of the appropriate material in relation to different parts of the plant or process. It is available on application from Henry Wiggin and Co. Ltd., Birmingham 16.

Conference on Materials of Construction

THE conference on "Materials of Construction for the Chemical Industry" which the Society of Chemical Industry is organising in Birmingham from 18th to 20th April, 1950, will now be held in the New University Buildings at Edgbaston and not at the old Mason College Buildings as was originally announced. The Conference is open to

members and other interested persons on payment of the appropriate fees. These have been fixed at 10s. for members of the Society and £2 for non-members, including in each case a copy of the preprinted contributions to the Conference.

The provisional programme of the Conference is as follows:

SESSION I

Chairman: Dr. F. M. Lea.

<i>Author</i>	<i>Title of paper</i>
Dr. W. L. German and Mr. S. W. Ratcliffe	"Bricks and tiles"
Mr. L. H. Griffiths	"Corrosion-resistant floors"
Mr. R. Ward	"Acid- and alkali-resistant cements"
Mr. G. N. Hodson	"Chemical stoneware as a material of construction"
Mr. A. V. Hussey and Mr. T. D. Robson	"High-alumina cement as a constructional material in the chemical industry"
Dr. N. Davey	"Concrete quality and durability"
Mr. L. Marsden	"Design of corrosion-resistant floors"

SESSION II

Chairman: Mr. Norman C. Fraser.

<i>Author</i>	<i>Title of paper</i>
Mr. W. G. Campbell	"The use of timber in the chemical industry"
Mr. N. Clarke-Jones	"Vermiculite"
Mr. D. C. Broome	"Asphalt in chemical factories"
Mr. J. B. Blakeley	"Asbestos"
Mr. F. Johnson	"Thermal insulating materials"

SESSION III

Chairman: Sir Charles Goodeve.

<i>Author</i>	<i>Title of paper</i>
Dr. N. P. Inglis	"User aspects of ferrous metals for general chemicals"
Mr. E. W. Colbeck	"Creep- and heat-resisting steels for the chemical industry"
Dr. R. V. Riley, Mr. J. R. Park and Mr. K. Southwick	"Cast iron and high-silicon acid-resisting irons"
Dr. Geerlings and Mr. W. P. Kerkhof	"User aspects, including corrosion, in oil refining and by-products"
Mr. J. A. McWilliam	"Methods of fabrication of stainless steels as materials of construction"

SESSION IV

Chairman: Dr. C. H. Desch

<i>Author</i>	<i>Title of paper</i>
Mr. G. A. Dummatt	"Uses of aluminium"
Mr. Arnold Lloyd	"Lead as a material of construction"
Dr. E. S. Hedges	"The uses of tin in the chemical industries"
Dr. Maurice Cook	"Copper and copper alloys for chemical plant"
Dr. J. M. Pirie	"Noble metals"

SESSION V

Chairman: Dr. N. J. L. Megson.

Author	Title of paper
Mr. G. Haim and Dr. H. P. Zade	"Application of welding to the production of chemically resistant plant and equipment"
Dr. F. F. Jaray	"Construction of chemical-resistant plant from such materials as p.v.c."
Mr. R. F. Reynolds	"Rubber and its derivatives as protective coatings for metals"
Mr. N. Swindin	"Rubber in chemical engineering"
Mr. Brian N. Reavell	"Plastics for large chemical plant"
Mr. T. A. Stanley	"General aspects of the application of plastics to chemical plant"

SESSION VI

Chairman: Mr. A. V. Hussey.

Author	Title of paper
Prof. H. Moore	"The use of glass for constructing chemical plant"
Mr. L. R. Barrett	"Refractories"
Mr. J. G. Window and Mr. J. F. Stirling	"Glass as a material of construction in the chemical industry"
Mr. C. L. Bodvan-Griffith	"Carbon and graphite"
Dr. G. E. Stephenson	"Fused silica"
Mr. J. G. Bennett	"Delanium—impermeable dense carbon for chemical construction"
Mr. H. D. Macmurray and Mr. J. D. Currie	"The application of glass linings to chemical process plant"

Applications for membership of the Conference should be addressed to the General Secretary of the Society, 56 Victoria Street, London, S.W.1, from whom any further details may be obtained.

MR. STANLEY HIND

MR. STANLEY HIND, B.Sc., A.R.C.S., F.R.I.C., of The Mount, Basford, Stoke-on-Trent, is shortly to resume his practice as consultant ceramic engineer.

In 1939 Mr. Hind relinquished his private practice, in which he had been engaged for nine years, to accept a position on the board of Pilkington's Tiles Ltd., the well-known glazed wall and floor tile manufacturers, of Clifton Junction, Manchester. For some years he was in charge of production, and also raised and commanded the works Home Guard unit.

He subsequently joined Doulton and Co., with whom he has of late years been in charge of research development work, and technical director of the Pottery Experimental Group, a group of manufacturers under the chairmanship of Mr. Cuthbert Bailey.

Mr. Hind will continue to be retained as consultant by the Doulton group of factories, thus maintaining an almost unbroken period of service to that firm since 1932.

He represents the Ceramic Industry on the Drying Panel of the Ministry of Fuel and Power's Fuel Efficiency Committee, is a member of the Engineering and Drying Panels of the British Ceramic Research

Association, and a member of the Council of the North Staffordshire Fuel Society. His work on many technical aspects of the pottery industry is well known, as a joint inventor of a number of machines, as the author of the recognised standard work on "Ovens, Fuels and Firing," and particularly for his extensive experience of tunnel kilns, on which subject he has made many contributions to progress.

We wish Mr. Hind every success in his resumed practice.

Correspondence

(To the Editor, CERAMICS.)

SIR,—The editorial on page 509 of Vol. 1, dated December, 1949, No. 10, has been read with great interest and approval.

This article, "Theory versus Practice; the Festival of Britain; Scientist Closed Shop"—is certainly the finest observation of a prevalent condition that I have ever read.

This letter is just to inform you how much I appreciated this article.

Very truly yours,

F. K. ILIFF,

Technical Sales—Ceramics,
THE HARSHAW CHEMICAL CO.

Pro tem. I take a bow! But there's one arm lifted, awaiting the brickbats! —ARGUS.

BRITISH INDUSTRIES FAIR

A Pre-View of Birmingham Exhibits

BRITISH JEFFREY-DIAMOND LTD.

THERE is a machine in the B.J.-D. range of breaking, crushing, pulverising and grinding machines for friable materials to suit product requirements from 8 in. cube down to minus 300 mesh in capacities from a few hundredweights to hundreds of tons per hour. Several of these machines can be adapted for shredding fibrous materials.

On Stand No. D 526 at the Birmingham Section of the 1950 British Industries Fair will be displayed a selection of machines from current production.

One feature common to all machines, whether a single roll breaker for the coarser products, or the Atomill grinder for the finest, is their ability to produce the required product in one passage through the machine. They are also compact for ready inclusion in new or existing crushing and screening plants and are accessibly arranged for inspection, cleaning and maintenance.

24 in. x 36 in. Mark II Single Roll Breaker. Fig. 1.

The range of products obtainable from B.J.-D. single roll breakers is from 8 in. to

1½ in. square mesh, in capacities from 10 to 550 t.p.h. They can be fitted with a patented oscillating breaker plate (as the machine exhibited) for handling large, hard feeds, or when a minimum of fines and oversize is desired. The exhibition machine has been sold to reduce 100 t.p.h. of 0/16 in. cube medium hard bituminous coal, to a product all below 3 in. square mesh screen, and will be installed at Aarhus Gas Works, Denmark.

42 in. x 36 in. Mark I Flextooth Crusher. Fig. 2.

The Flextooth crusher is a medium speed hammer crusher with a product range between 1½ in. and ½ in. square mesh in capacities from 8 to 350 t.p.h. Standard safety devices include a spring-loaded breaker plate, pivoted hammers, shear pin device, and a metal trap. The exhibition machine has been sold for shipment to Malaya for coal-sizing to ½ in. at the rate of 200 t.p.h.

36 in. x 36 in. Swing Hammer Pulveriser. Fig. 4.

B.J.-D. swing hammer pulverisers are high-speed hammer mills for reducing friable materials to products between ½ in. square mesh and 100 B.S. mesh in capaci-

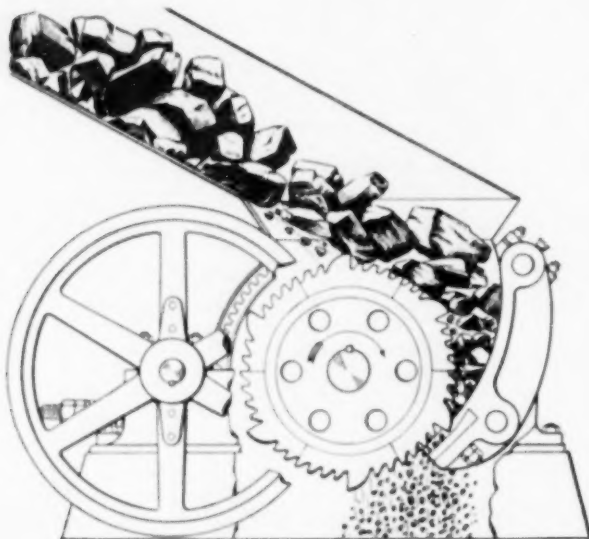
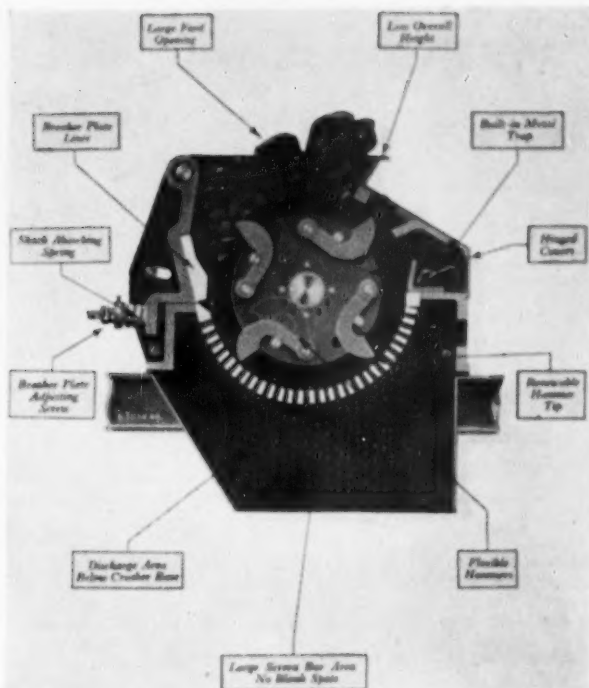


Fig. 1
Mark II single roll
breaker, showing
method of feeding

Fig. 2
Details of Flextooth
crusher



ties from 1 to 200 or more t.p.h. A patented circulating oil system on the larger machines (as the unit exhibited) ensures adequately controlled lubrication. They can be adapted for shredding fibrous materials. The exhibition machine has been sold for reducing coal at 90 t.p.h. to 80 per cent. passing $\frac{1}{2}$ in. screen for coke-

oven purposes, and will be installed in Finland.

"Atomill" Fine Grinder. Fig. 3.

The "Atomill" is a high-speed hammer mill which reduces friable materials to between 50 and 300 B.S. mesh at various capacities, according to the type of mate-

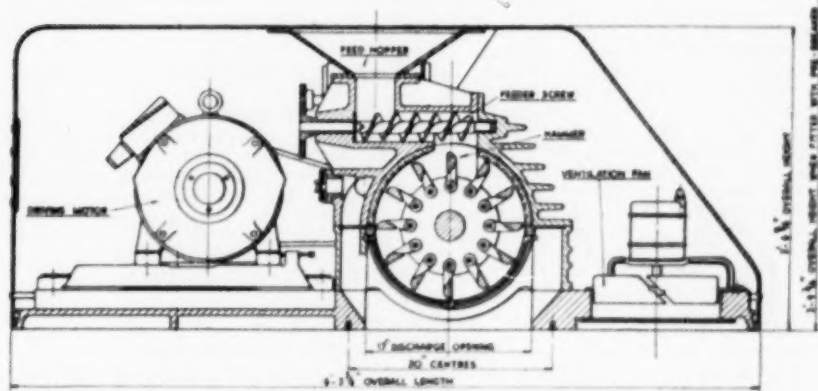


Fig. 3. Arrangement of B.J.-D. "Atomill"

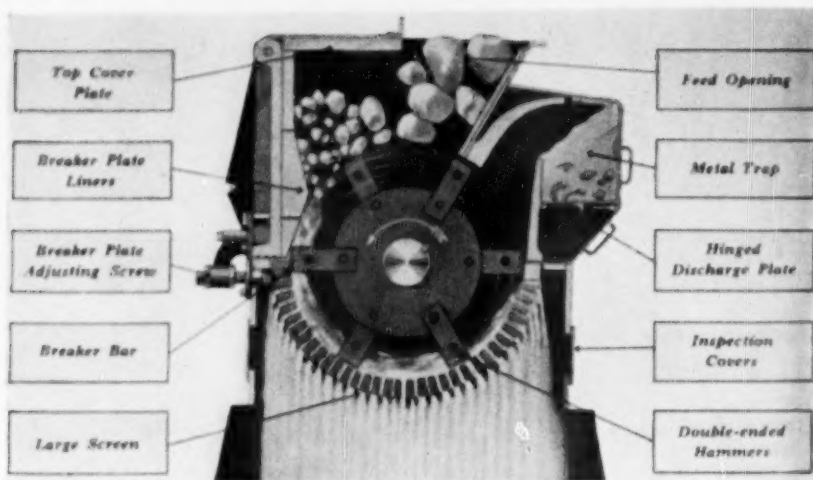


Fig. 4. Sectional illustration of swing hammer pulveriser with metal trap

rial and the product size required. It is self-contained, totally enclosed, dustless, hygienic and compact, and can be arranged for periodic or continuous operation.

"Midget Atomill" Fine Grinder.

Designed essentially for laboratory use,

but robust enough for small-scale batch operation, the B.J.-D. Midget Atomill incorporates all the established features of the standard machine with a high degree of accessibility to ensure quick and easy dismantling for cleaning either by brushing or washing.

SPECIAL CONTRACTORS' PLANT DISPLAY

THE first loads of more than 1,000 tons of engineering exhibits are now being moved into position at Castle Bromwich, Birmingham, in preparation for the 1950 British Industries Fair.

Site preparations for the London Sections of the Fair (Olympia and Earl's Court) will not start until the first week in April. Unlike Castle Bromwich, the London buildings are not available to the organisers of the Fair all the year round.

One of the first exhibits to arrive at Castle Bromwich was a 15 ton mixing machine for the artificial silk industry. Other items expected in the next week or two include a giant pile-driver 80 ft. high, a stone-crusher of 40 tons, a roadmaking "factory" 90 ft. long and 27 ft. high.

Many of the heaviest exhibits at the B.I.F. this year will be found in the special display at Birmingham of civil engineering contractors' plant, in which twenty-nine manufacturers will present the latest products which they are currently exporting to 70 countries.

Organised by the Federation of Manufacturers of Contractors' Plant, this display

will occupy some 65,000 square feet of actual stand space.

The following brief details of exhibits in the display are based on information supplied to the organisers of the Fair by the exhibitors concerned.

Frederick Parker Ltd., Catherine Street, Leicester.

Portable roadmaking "factory," measuring 90 ft. in length and 27 ft. high, and weighing 44 tons, which can be collapsed to form three units for towing along the highway. Also portable storage unit for quarry and gravel plant, and a 1 h.p. mobile concrete mixer for farmers and small builders which weighs 5½ cwt. Firm exporting to twelve countries.

Goodwin, Barsby and Co. Ltd., St. Margaret's Ironworks, Leicester.

Steel jawbreaker weighing 40 tons which crushes rock into aggregate for concrete at the rate of 100 tons an hour. Also portable crusher for public works

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CERAMICS

departments which is complete with a screen for separating various sizes of stone.

Aveling Barford Ltd., Grantham, Lincs.

Britain's largest dumper, capacity 30,000 lb., powered by 6-cylinder Diesel of 128 h.p., which can plough through axle-deep mud or climb steep gradients. Available in two types, one for handling rock, the other for earth work. Special feature: reversible driving seat and controls so that driver can run the dumper in either direction.

Winget Ltd., Rochester, Kent.

Complete concrete mixing station plant for dam building and heavy industrial construction. A feature of this plant is that the complicated movements of all components may be centrally controlled from a master panel. Firm exporting to seven countries.

Chaseside Engineering Co. Ltd., Station Works, Hertford.

Mobile auto shovels, cranes, dumpers and shunting tractors to speed building

will be exhibiting at the Castle Bromwich Section are:

Wickham Engineering Co. Ltd., 34 Victoria Street, London, S.W.1.

Birtley Co. Ltd., Birtley, Co. Durham.

Consolidated Pneumatic Tool Co. Ltd., 232 Dawes Road, London, S.W.6.

Liner Concrete Machinery Co. Ltd., Gateshead, Co. Durham.

Millars' Machinery Co. Ltd., Bishops Stortford, Herts.

Stoher and Pitt Ltd., Bath, Somerset.

C. H. Johnson Ltd., Stockport, Cheshire.

Marshall Sons and Co. Ltd., Gainsborough, Lincoln.

Onions and Sons Ltd., Bilston, Staffs.

Pegson Ltd., Coalville, Leicester.

Thomas Smith and Sons Ltd., Rodley, Leeds.

MONO PUMPS LTD.

DURING the past few years we have been experiencing a period when all the ingenuity of the engineer has been required, both for the purpose of increas-



The H2B
Mono pump

and for mechanical handling in many industries. Firm exporting to fifty-five countries. Exports increased 60 per cent. in last twelve months.

R. H. Neal and Co. Ltd., Plant House, Ealing, London, W.5.

Mobile crane of 15 cwt. with telescopic jib which can be extended to 40 ft. Also a 10 ton Diesel mobile crane incorporating hydraulic controls and power-assisted steering.

George Fowell Ltd., Pabone Lane, Smethwick.

Fool-proof auto dumper which unskilled workers can learn to operate in ten minutes. Feature is a method of transmitting power from engine to gearbox by a rubber and composition belt worked in conjunction with a jockey pulley which is said to obviate damage resulting from violent declutching.

Other members of the Federation of Manufacturers of Contractors' Plant who

ing production and to combat labour costs and shortages. When the necessity arises, engineers are quick to adapt apparatus or machinery to their particular needs, but in many cases, any new production technique demands the utmost co-operation between the manufacturer of equipment and the user. One such branch of engineering which has made rapid strides in recent times is the mechanical handling of raw materials and finished products, many of which may be in liquid or pulp form. The conveyance of fluids brings its own peculiar trail of problems, due perhaps to low fluidity, abrasive content, corrosives or other causes. In this field, Mono Pumps Ltd. have closely followed engineers' requirements of today, and the Mono pump has been the means of developing many new production methods, particularly in the chemical, ceramic and finishing trades. The Mono pump consists essentially of a hardened metal rotor of special helical form which rotates in a stator which can be made in natural or

synthetic rubber, in plastics and in various metals. The nature of its construction lends itself to immense flexibility of application to modern industrial practice.

On Stand D 716 at the British Industries Fair at Birmingham, Mono Pumps Ltd. display their "D" type pumps for handling casting slip for ornamental and sanitary ware and for the transfer and sieving of slip. One of their "D" type pumps is demonstrated by circulating a particularly viscous mixture of lime sludge. In addition they show a small 60 g.p.h. pump suitable for laboratory use.

CHANCE BROTHERS LTD.

CHANCE BROTHERS LTD., of Smethwick, Birmingham, give the following information concerning exhibits to be shown by them at the B.I.F., both Castle Bromwich and Earl's Court Sections.

At Castle Bromwich the Chance Square Beam Airport Location Beacon will be exhibited for the first time. Approved by British Air Ministry for standard use in British civil airports, the beacon has a flash duration of 0.2 seconds, peak intensity of beam 2.5 million candle power, and a luminous range up to 60 miles under clear weather conditions.

Sumo Submersible Electric Pumping Units, for use in laundries, breweries, dairies, refineries, etc., and the Flame-master gas hand-torch for light welding and glass-working will also be on show.

At Earl's Court, Chance Brothers will introduce "Britannia," a new design in automatic machine-pressed domestic glassware, the first machine-moulded pattern to exploit the traditional principles which have been applied in the hand-cutting of glass for generations.

GRAFTON POTTERY KILN

THE Applied Heat Co. Ltd., of Watford, announce that, in conjunction with their parent company, Wild-Barfield Electric Furnaces Ltd., they will be exhibiting at the British Industries Fair, Castle Bromwich Section. Details of the exhibit are as follows:

Even heating and cooling, features of this electric pottery kiln have been ensured by the use of correct insulation and refractory materials in proper proportions in conjunction with adequate heating elements made from material chosen on account of its long life at the more elevated temperatures normally demanded of a kiln. The doors are so designed that distortion is eliminated, thus maintaining even heating throughout the firing chamber and reducing heat losses to a minimum throughout its range of temperatures up to 1,300° C. (2,372° F.) for standard models and 1,350° C. (2,462° F.) in special models.

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Vitreous Enamelling

A Survey of Modern Practice and Furnace Equipment

RECENT developments in porcelain enamelling box and continuous furnaces warrant a careful analysis of the furnace requirements, either when considering extension to existing plant or when laying down new plant. Some of the principal factors involved when deciding on the type and size of furnace to install may be enumerated as follows.

Ample furnace capacity is of course, essential for all plant. Correct sizing of the furnace is important, not only from a production standpoint but also for economy. For jobbing works, the furnace should be capable of handling any pieces of reasonable size that is likely to come along. Then there is the question to consider when installing a new furnace as to possible future enlargement of furnace productive capacity, either for handling bigger items or else for increased tonnage.

Adding a few feet on to a continuous type furnace can add 20 to 25 per cent. more to the production obtained. Then there is the aspect of possible future increasing of the working height of continuous and box furnaces so as to accommodate larger units, again increasing capacity and output.

Furnace muffles and pier brick need careful attention. Every item on the furnace, structural details, temperature and safety control instruments, overhead conveyors and accessories, all need careful scrutiny.

CONTINUOUS FURNACES

On a continuous furnace, the introduction of a "dirt-proof" slot, independent roof suspension, centre wall muffle, quick detachable drop rods and countless other improvements that have been made with the development of this type of furnace over the last few years, all need close attention and serious consideration. Trouble-free and dirt-proof conveyor slots are most

important where the products are large, such as sinks, baths and washing machine tubs. The decision will have to be made also as to the type of fuel that is going to be employed. This will involve considerations as to whether an electric or gas-fired furnace is to be chosen, and whether the furnace is going to be of the muffle or radiant tube type.

Recuperators installed in furnace stacks have proved themselves very efficient and, as a rule, have paid for themselves in less than two years. Proper safety and control equipment is a vital necessity on modern furnaces. Equipment should be installed to give protection against power, fuel and air supply failure. Protection against overheating, in case of failure of the temperature control system, should also be provided. Improved designs in gas and oil burners have made for more efficient fuel consumption. Door raising and ware loading and unloading systems, in the case of batch type furnaces should be of suitable design, embodying electrically operated door hoists and speed forks.

Conveyors

Handling the ware to and from the furnace is an important production stage and should be regarded as such. Adequate handling equipment will serve to reduce costs quite appreciably. The installation of conveyors will save many man hours, improve production and reduce spoiled ware due to handling. In every porcelain enamelling operation, a suitable conveyor can be installed to improve efficiency. Whatever the process involved, an overhead, lay down cable or slat-type conveyor can be installed.

FURNACES FOR LARGE-SCALE PRODUCTION

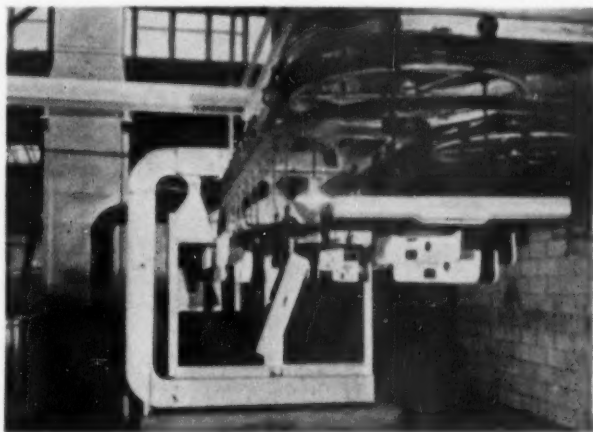
An interesting example of continuous gas-fired enamelling furnaces is provided

by the plant installed in the works of the American Stove Company, at St. Louis, U.S.A. The installation of two continuous gas-fired furnaces, served to step up the production of vitreous enamelled gas cooker parts to a very great extent. The new plant increased gas stove production from a former rate of 400 per day to a figure several times that amount. The new furnace plant was planned to handle the entire output, the furnace building being 320 ft. long by 184 ft. wide, all this space being devoted exclusively to vitreous enamel firing operations of stove sheet parts from the adjoining storage rooms.

The enamelling plant includes a

mile trip before completion. On the chain, the stove parts move to the frit spray chambers on the left wall of the plant for the initial ground coat, where they are dipped. Frit before firing is baked in a 100 ft. gas-fired drying tunnel of the open burner type, at approximately 300° F. This replaces a former drying tunnel which had to be operated at 600° F. with a short heat zone and resulted in many mottled, spotted enamelling jobs because of loss of frit when the hot metal was sprayed on later. Drying time on the new conveyor type oven is 1½ min., utilising adjustable "A" racks to accommodate all sizes of stove parts and sheets.

Fig. 1. Modern gas-fired continuous porcelain enamelling furnace



large pickling room, automatic chain conveyor system 3,000 ft. long and separate furnaces for ground coat and cover coat operations. In this up-to-date vitreous enamelling plant, production is on a "start and stop" basis, entirely automatic throughout. The plant production is arranged to work against two storage rooms of stove parts; one storing metal parts drawn, welded and fabricated ready for ground coat firing, and another of finished and trimmed ground coat parts, inventoried against cover coat processing.

The raw material parts pass through a 45 ft. by 160 ft. pickling room, as the first step. Emerging in baskets, they go on to the 3,000 ft. conveyor chain which circulates through every department in the plant, making a half

Ground Coat Firing

Ground coat firing is carried out in the unit of two new hairpin type continuous furnaces at the rear. These are twenty-two burner, eleven zone furnaces, 90 ft. long, with a 70 ft. hot zone, producing temperatures of 1,520 to 1,530° F. through high pressure, muffle type burners at 30 lb. per sq. in. The 180 ft. travel through the furnace allows for 60 ft. of preheating space as well as 60 ft. of cooling area.

The use of "equalisation burners" is one unusual feature of the two furnaces installed. The cross-fire installation in each zone consists of a 60 per cent. burner at the top and a 40 per cent. below, which equalises heat and prevents cold spots in the furnace which otherwise might exist. It was found that burners of equal

CERAMICS

capacity firing through the burner block imparted a rotary motion to the flame, causing the shell to buckle and the installation to burn out quickly. The 60-40 installation in both of the furnaces is expected to give a smooth 1,000,000 B.Th.U. per hr. consumption, consuming 1,000 c. ft. of gas per hr. per burner. For minimum fire, the gas flow is by-passed through a diaphragm regulator, the surge taken up by the use of a 4 in. gas supply line. This burner design, as well as the use of the alundum refractory lining material has resulted from previous experience.

The ground coat of frit is fired in this manner at the rate of 17 ft. per min. through the furnace. The parts emerging are cooled and stored in a second large storage room, ready for picking up at any time for the cover coat. Air seals at the intake and output sides of the furnace serve to hold in the heat efficiently.

Automatic Spraying Machines for Cover Coat

The process is similar with the finished ground coat stove parts. Stock taken from storage is first trimmed and inspected, and hooked on to the overhead conveyor chain, to pass through one of the two automatic spraying machines which apply the white cover coat of frit. This wet coat is slowly baked dry for firing in passing along a 100 ft. gas-fired oven at 450° F.; 70 ft. of open conveyor line are devoted to cooling the dried frit and brushing before firing.

Through an ingenious switch track system built into the chain conveyor, it is possible to use either furnace for ground coat or cover coat operations as desired. The final firing is conducted at a rate of 17 ft. per min. or better, after which the glossy white stove parts are inspected and travel by conveyor to the finish stock storage room, from which they are requisitioned by the assembly plant.

BATCH TYPE ENAMELLING FURNACES

Some detailed information regarding the operation of a gas-fired box type enamelling furnace was provided in a paper by S. Ryder to the Institute of Vitreous Enamellers. The furnace on

which the operating data was obtained was a 12 ft. by 5 ft. muffle box furnace with a V-type bottom. The complete muffle, including the V bottom, was constructed of fused alumina tiles. The side walls were 3 ft. high with a further 2 ft. rise of arch. This muffle height enables hanging or leaning loads to be fired with quite large pieces. The furnace was fired with town's gas with a nominal calorific value of 450 B.Th.U. per c. ft.

Six gas burners were installed on the furnaces, three front and three back, firing into horizontal combustion chambers running the full length of the furnace, front to back, the V tiles

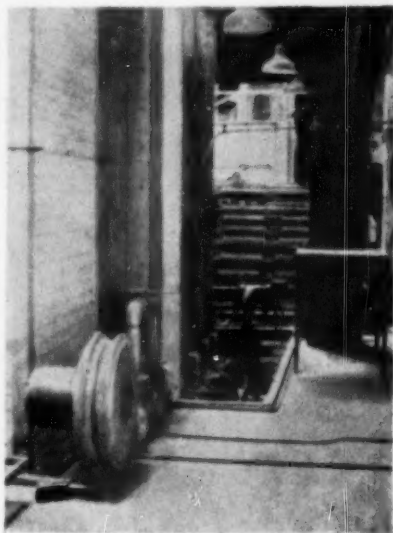


Fig. 2. View of rear of furnace

of the muffle bottom forming the roof of the combustion chambers and also acting as landing walls for the load. The hot gases from the combustion chamber passed up the side walls and over the roof of the muffle to the waste gas flue. The gas burners were of the air blast type, air being provided at a pressure of 1 lb. per sq. in. by a 6 h.p. blower. All the air for combustion was provided by the blast and there was no secondary air supply. The burner consisted of a central throat through which the air was blown, and a gas supply mounted on the side and connected to the throat. A governor on the gas supply reduced

the gas to zero pressure. The gas was drawn into the burner by the suction produced by the blast. If, therefore, the blast failed for any reason, no gas passed into the combustion flues. Each burner was provided with an adjustment on the gas supply, to enable it to be set for the correct air/gas ratio, and once this was done, no further adjustment was necessary.

The furnace was well insulated, the temperature of the sides, back and top averaging approximately 100° F. above air temperature. Insulating brick, insulating powder and asbestos pads were used for insulating. The damper setting did not affect the combustion air in any way, since this all comes from the blower, but the damper setting did affect the amount of excess air drawn in through lighter holes, etc.

The temperature controller operated through a motorised butterfly valve on the air line between the blower and the burners. When the furnace is up to the pre-set temperature the butterfly valve closes and the only air then passing to the burners is through a by-pass, which passes sufficient air to inspire about 1,400 c. ft. of gas per hr.

A number of test runs were made on the furnace when fusing sheet iron to ascertain the most economical operating conditions, and the heat balances obtained from these tests are shown in Table 1.

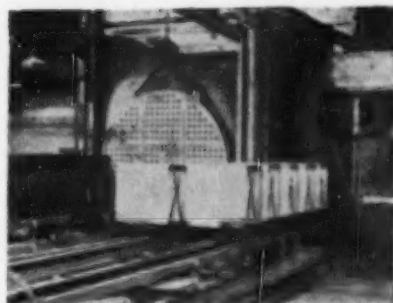


Fig. 3. Hanging perrets

is fired. A larger thermal input can be obtained on a furnace with town's gas firing than perhaps any other type of fuel. The test figures showed that the faster the muffle type of furnace is worked the more economical it will be. In many enamelling plants, a fusing rate of about seven loads per hour is common practice. In the plant on which the tests were conducted, it was found that with the type of work being handled, it was not possible to exceed an average of seven or eight loads per hour with two men working the furnace. Three men per furnace were used and the fusing rate then averaged nearly eleven loads per hour. For economical running a furnace must be worked to maximum capacity and this implies that it is unwise to try and save labour if this means that the furnace is not being absolutely

TABLE 1
HEAT BALANCES FOR FURNACE DURING TEST RUNS

	300 sq. ft. per hour (flat load)	600 sq. ft. per hour (flat load)	Hanging Loads	300 sq. ft. per hour 8.5% CO ₂ in flue gases
Heat passing into ware	6.5	9.5	10	6
Heat passing into perrets	14	16.5	12	14
Stack loss	48.5	44.5	45	57
Radiation and convection loss through walls and bottom, and through door opening	31	29.5	33	23

General Considerations

Facts which emerged from the test indicated that the manner in which the furnace is normally operated can have a considerable influence on the thermal efficiency obtained and this will also depend to some extent on the type of fuel with which the furnace

fully used. A view of the furnace is shown in Fig. 2. This shows the arrangement at the rear of the furnace, including the blower, automatic valve, three burners with air and gas supply, and the back pressure safety valve on the gas lines. The furnace with hanging perrets is shown in Fig. 3.

The Manufacture of Ceramic Transfers

SPECIALLY CONTRIBUTED

AT the present time there is a greater demand for decorated pottery than the industry can supply, and the output is restricted by the scarcity of decorators. Since painters cannot be trained quickly, more and more decoration is being done with the aid of ceramic transfers, or lithographs, since an operative can be trained to use them in a relatively short time. Thus the bottleneck in production has to some extent shifted to the production of lithos. Much is being done to ease this, but the process is such a skilled one, and the machinery required so specialised, that increased production, on a scale to satisfy all demands, including those of the export market, will not be achieved easily.

Origin of the Art

Ceramic transfers are thus of such importance that a simple explanation of the methods of making them should

be of interest. The art of lithography has been known for a long time. The name is derived from the Greek words "lithos" a stone, and "graphein" to write, and the process thus comprises the art of reproducing drawings, print, etc., from designs previously traced on stone. Aloys Senefelder invented the process at Munich in 1796, and he used a kind of limestone found at Solenhofen, about fifty miles to the north of the city. For long these quarries had a monopoly of lithographic stone, which was exported in considerable quantities to the U.S.A., and to other parts of the world. Senefelder patented his process in 1800, and later opened works in London and Paris. Like many other processes in those days, the art was kept secret, and it was not for many years that it became widely known and used.

Broadly the principles of the process are as follows:—



(Courtesy: W. H. Grindley & Co. Ltd., Tunstall)

Lithographers applying ceramic transfers



(Courtesy: W. H. Grindley & Co. Ltd., Tunstall)

Gilders lining decorated ware

1. Greasy substances will adhere to finely polished calcareous stones, e.g. limestone.

2. Once on the stone the grease will attract printing ink and repel water.

3. Water can penetrate those parts of the stone not containing grease, and the wet parts will not pick up printing ink.

4. A paper pressed into contact with the stone after being charged with ink will pick up an impression of the design previously drawn on it.

In order to prepare a lithograph then, the stone is first polished, and the design to be reproduced is drawn on it with a special lithographic ink, or crayon. Sometimes the design is first drawn on paper, and this is then pressed into contact with the stone to transfer the design to it. The lithographic ink or crayon contains the greasy substance, and is made of mixtures of substances like lard, soap, wax, and sometimes shellac and turpentine are added. Lampblack is added as a pigment to make the work visible.

After drawing on the stone, the printer "gums it up." This means that he rubs it over with a sponge dipped

in a solution of gum arabic. The gum desensitises the surface of the stone, and prevents the ink in the drawing from spreading. It also helps to prevent the uninked parts from going dry, when they would pick up ink and give dirty impressions. After "gumming up" and drying, the stone is sponged off and wiped with a damp cloth, and then an inked roller is used to "roll up" the stone. The grease attracts the ink, and the damp surface repels it, so that only the design receives the ink.

After this the work is dusted with an acid resist (french chalk) and etched with a sponge dipped in a weak solution of nitric acid. This removes superfluous grease from the stone face and renders it more grease repellant. After washing off, the gum rolling up operations are repeated, and then the stone is placed on the bed of a press, and an impression taken on paper. In a hand press the damping and rolling up with an ink roller must be repeated for every impression. For large printings a power press is used and the inking and damping done automatically.

CERAMICS

Use of Metal Plates

Since the design is drawn in grease which penetrates into the stone, it follows that the only way to remove it prior to using the stone again is to grind it off with an abrasive powder and repolish. This is a long and arduous process. Good litho stones, free from blemishes, are expensive. Moreover they occupy a good deal of storage space, and are difficult to handle. For these reasons, and also since metal plates can be fixed on rotary presses which operate at higher speeds, zinc and aluminium plates are finding increasing use in lithography.

Before use they must be grained in order to produce a surface which will carry water more easily than a polished one. This is done by placing the plate in a trough with porcelain balls and an abrasive powder with water. On shaking the trough in a rotary fashion the balls roll over the surface of the metal and roughen it, forming an even grain. When this process is complete the plate is washed off and sensitised and then prepared in the way indicated above for litho stones.

Reproduction of the Artist's Design

Having surveyed in outline the broad principles of lithography let us consider the application to the printing of ceramic transfers. In the first place the customer will submit an artist's drawing in colour, which he wishes to form the *motif* for decorating say, a tea set or a dinner service. An expert will be able to tell immediately how many colours will be needed to give the desired result. For the sake of argument we will suppose that this is twelve. This means that twelve plates will have to be produced—one for each colour—and that, in all, twelve printings will be required for every sheet of litho. The printer is thus able to estimate the price of the job. Obviously the greater the number of colours in the litho, the more expensive the job will be. The potter may decide to go ahead, or he may feel that the design is likely to be too expensive for the type of ware that he has in mind, in which case he will resort to another pattern involving less colours.

Cheaper lithos, of course, cannot reproduce the gradation of tone found



(Courtesy: W. H. Grindley & Co. Ltd., Tunstall)

Close-up showing the lining of decorated ware

in the more expensive ones. In the past there has been some prejudice against the use of lithos for decoration—possibly owing to the indiscriminate use of poor samples—but today the modern litho is used with fine results by the most reputable firms with world-wide reputations.

The pattern having been decided, the design must now be broken down into its component colours, and a stone or plate made for each. Thus for a twelve colour transfer it is necessary to produce twelve stones, one for the red, another for the blue, and so on for as many colours as the design contains. Needless to say each plate only contains a portion of the pattern. The production of these colour plates is either done by an artist by hand, or by the use of photography. We will consider photo-lithography in a later section.

One Plate for Each Colour

The commercial artist now has to make a drawing in lithographic ink, which is a greasy substance, for each coloured portion of the design, including all the various sizes of sprays, borders, etc., to fit the different sizes of ware which make up the set. In order to differentiate the depths of colour, he resorts to stippling with dots on his drawing. Highlights are left bare. These pieces of the design corresponding to one colour are then collected together, and fixed on a sheet of paper of the same size as the finished litho, say about 2 ft. by 2 ft. 8 in.

This sheet is then pressed into contact with the litho stone or metal plate, and an impression taken. This constitutes the key plate for one colour. The process is repeated so as to make sufficient plates to give the full number of colours required in the finished pattern. For twelve colours twelve plates are produced. Needless to say these colour plates must register exactly when the printing is done, or the result would be lack of definition.

Printing of Colours

In ordinary colour printing the colours are printed directly on to the paper. In ceramic litho printing this is only possible with a few colours which can be mixed in sufficient strength to print directly on the paper.

Instead, an impression is printed on the paper in greasy material, and then the colour is dusted on it. For this purpose the colour plate or stone is clamped in a printing machine, and after the grease impression is applied, the sheet is passed through a special machine where flannel pads apply the powdered colour. The colour adheres to the grease, and then the excess is removed by passing through another machine fitted with rotating feather brushes. Separate machines are used for each colour. An expert decides the order of printing the colours so as to produce the best result. What must clearly be understood is that the final sheet is produced by gradually building it up, printing in each colour as a grease impression, and then dusting on the appropriate colour.

Printing Papers

Printing in this country is done on a duplex paper. This is a sheet of special tissue paper to carry the transfer, backed by a thicker one which strengthens it for storage, and for cutting and handling in the workshop. Before attaching to the ware the backing paper is removed. Some Continental firms use a single sheet, called a Simplex paper. This is not as easily applied to curved surfaces, and is not popular in this country. It will be remembered that after rubbing down the litho on the size the tissue paper is sponged off, leaving the coloured pattern in position on the ware.

In this condition the colours are held together by a transparent layer of size, which is applied to the sheet after the printing is complete. This layer also serves to protect the colours on storage. Needless to say the printing of small quantities of lithos is not an economical proposition, and a normal order runs into several thousand sheets.

Photo Lithography

It will be evident from what has already been said that the production of lithos by drawing each of the coloured portions of the design is a long and skilled operation. Consequently any method of using mechanical aids to ease this is very welcome, in these days when ceramic transfers are in such great demand.

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One recent development is the use of photography to produce the various plates corresponding to the different coloured portions of the design, and which will be needed for printing the litho sheets. An outline of this method was given by Mr. Dearden of the Stoke School of Art to the Ceramic Society in a lecture in 1943 (c.f. *Trans. Brit. Ceram. Soc.* 43.68.1943) and further elaborated in another lecture delivered to the same Society in last winter's session. An excellent explanation of the process will also be found in *Glass Industry* for 1937, by V. H. Remington.

Details of Process

The design is set up on an easel, where it can be illuminated by powerful carbon arc lamps. Using a large copying camera the design is focussed on the screen, and then a suitable filter is placed over the lens. Thus, if a red filter is used, only the red parts of the design will be transmitted through the lens to the photographic plate in the camera. A sensitive panchromatic plate is used to photograph the transmitted red image, and developed in the usual way. This is repeated with a green filter to record the green parts of the design, and so on for the other colours, using appropriate filters. If the stippled effect of fine dots is required, then a fine screen is interposed between the lens and the plate. This series of colour separation negatives is used to prepare lithographic key plates for the various colours of the design.

The metal plate, grained by the process described above, is coated with gum - bichromate, or a similar mixture with albumen in place of the gum. It is dried by rotating it in a current of warm air. It is now light-sensitive and must be handled in a safe light, though the plate is not a fast one. One sensitizer recommended in the literature is made up as follows:—

Dissolve in hot water (2 qts.) 8 oz. gelatine, 1.33 oz. potassium dichromate and 1.33 oz. of ground sugar candy. This solution is strained and is applied hot to the plate. It sets on cooling. After drying in the dark as described above the plate can be handled in a room illuminated by a 40 watt lamp.

The sensitised metal plate is placed behind the appropriate colour separation negative in a printing frame and exposed to a powerful light from a carbon arc lamp. The duration of the exposure required depends on the density of the negative and the intensity of the light from the carbon arc.

After exposure to the light in the frame, the entire surface of the plate is covered with lithographic ink, and it is then developed by treatment with warm water. Those parts of the plate which have received the light are hardened, and will not dissolve away in the warm water, the other parts dissolve away taking the litho ink with them. Hence we are left with a positive of those parts of the design corresponding to a particular colour in hardened gum coated with lithographic ink. The plate is then etched with a salt solution to destroy any tendency of those parts of the plate which are not required to print from picking up grease.

From now on the plate is "gummed up" and prepared in exactly the same way as already described and, as before, as many plates are required as colours in the design. This method of preparing the printing plates saves a lot of laborious work, and also produces greater gradation of tone than is possible by drawing and stippling. Lithos produced in this way give effects similar to those given by hand painting.

Silk Screen Process

Another method of producing transfers which has recently been adopted in this country is what is called the silk screen process. This depends on the fact that a piece of silk or fine wire mesh can be treated in such a way that some of the meshes can be filled up to form a pattern, and this can then be used as a stencil. If placed in contact with paper, and then an inked squeegee passed over it, the colour passes through the open meshes to the paper, leaving clear paper behind the blocked out design (or stencil). The problem, therefore, is to place the design on the silk screen. In the simplest form the design can be traced on the silk with a pencil and then the design blocked out with a filling material which does not transmit colour, such as gold size or varnish.

The ceramic colour can then be squeezed through on to the paper.

For the preparation of transfers in several colours it is necessary to prepare silk screens corresponding to each colour, just as with litho stones or metal plates. One convenient way of doing this is to coat the silk with a light-sensitive gum-bichromate solution, and to use this to produce screens corresponding to the various colours in the way already described. These can then be used in turn to print the corresponding colours on to the litho paper, taking care that each colour is in register with the previous one. Transfers made in this way have rather thicker deposits of colour on them than in other types, and produce a relief effect similar to that given by brush work. To date in this country it has not been possible to produce transfers economically by this method with more than about six colours, as the squeegeeing is done by hand. Probably it is only a matter of time before machines will be evolved for doing this. This type of litho can be

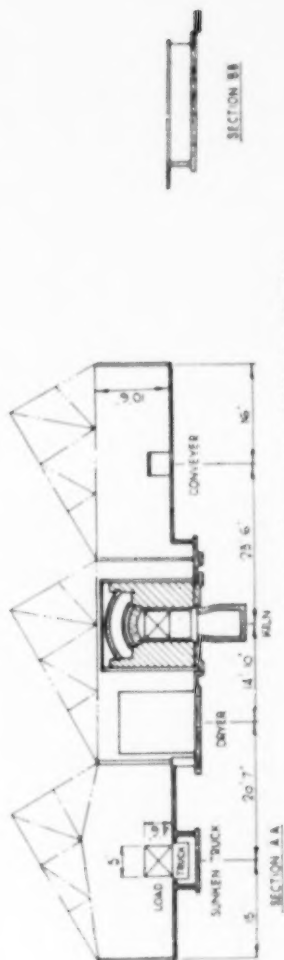
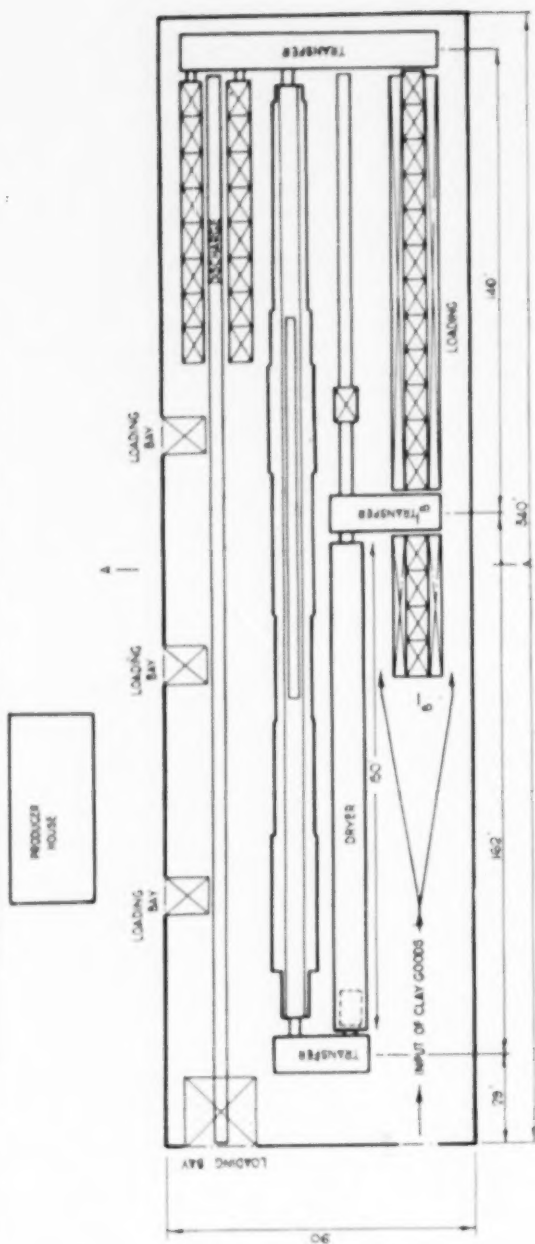
fixed on ware with the aid of a size in the usual way.

Lately another type of transfer has been produced in which the colour rests on a film of collodion, gummed to backing paper. To use this transfer it is laid face upwards on a damp pad until the backing paper has become soaked and has uncured. The transfer can then be slid off from the backing paper. The collodion film is then applied to the ware face upwards. Provided the transfer has not been soaked too long, sufficient gum from the backing paper remains on the collodion film to secure it to the ware before firing. It is claimed that this operation is simpler than the usual methods employing litho size, and, in any case, as very thick layers of enamel are printed on to the paper by the silk screen method the top surface is not sufficiently flat to be applied face down on the ware. Care is needed in applying these transfers to curved surfaces to prevent cracking of the enamel colour. These transfers are also produced by the silk-screen method.

GLASS DISPLAY AT IDEAL HOMES EXHIBITION



Centre-piece of the 17th century banqueting table in the French Government exhibit at the recent Ideal Homes Exhibition, Olympia



Layout of new tunnel kiln installation



Loading trucks with green refractory specials. Dryer entrance in background

New Tunnel Kiln For Refractory Special Installations

At Gibbons (Dudley) Ltd.

SINCE the summer of 1949 Gibbons (Dudley) Ltd. have had in full production at their refractory firebrick works a new tunnel kiln, designed and built by their associate company Gibbons Brothers Ltd., who specialise in tunnel kiln installations. The plant being of the most advanced type, no doubt a description of its main features will be of interest to refractory manufacturers.

Layout

The layout consists of a three-bay building housing a tunnel dryer 160 ft. long, a tunnel kiln 310 ft. long, two loading tracks, two unloading tracks, and a rubber belt conveyor for transfer of fired goods from the unloading tracks to the various sections of the stocking bay.

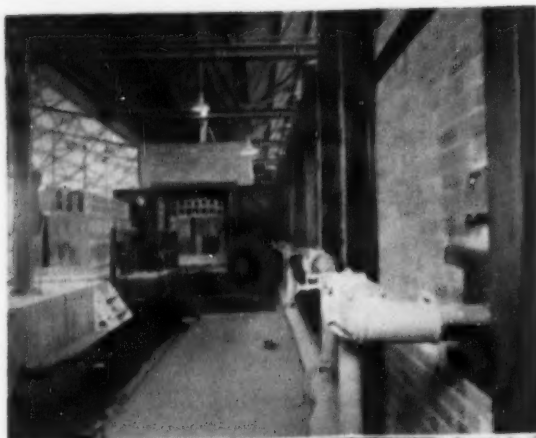
The unfired shapes are brought from the adjacent moulding floors to the

loading bay by a 2-ton capacity electric truck, the goods being just sufficiently dry to enable them to withstand setting on the kiln trucks without squatting. A very large range of sizes is handled ranging from small specials, regenerator tubes, muffle chamber fronts, to large and solid specials 8 in. thick, weighing up to 155 lb. Weekly production runs at 207 tons burnt weight.

Fabricated steel construction has been employed for the kiln trucks which are 9 ft. 10½ in. long and 6 ft. wide; the load carried being 5 ft. wide by 5 ft. high, set directly on the truck brickwork. One truck enters the kiln every five hours fifteen minutes, propulsion through kiln being by continuously moving hydraulic pusher.

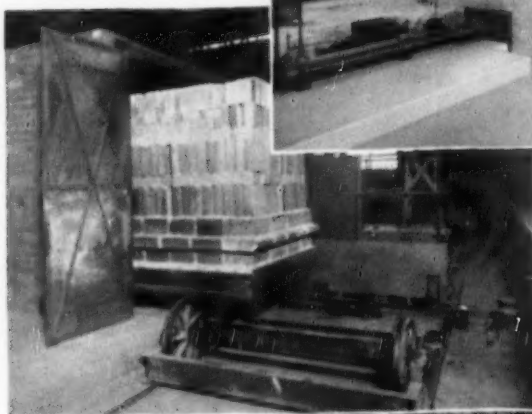
In view of the heavy weight of the loaded trucks, which average about 12 tons, the three transfer trucks

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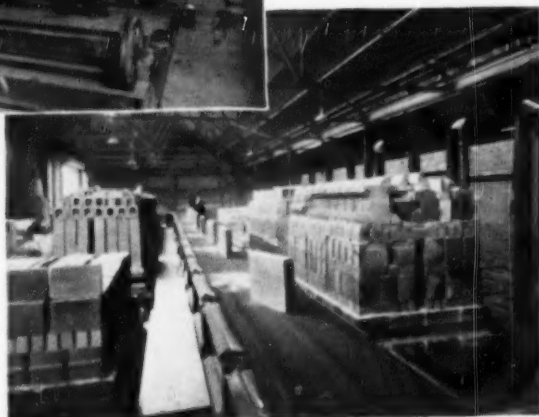
(Left) Loaded trucks being transferred to tunnel dryer by means of electric transfer truck. Mechanical pusher is shown in foreground

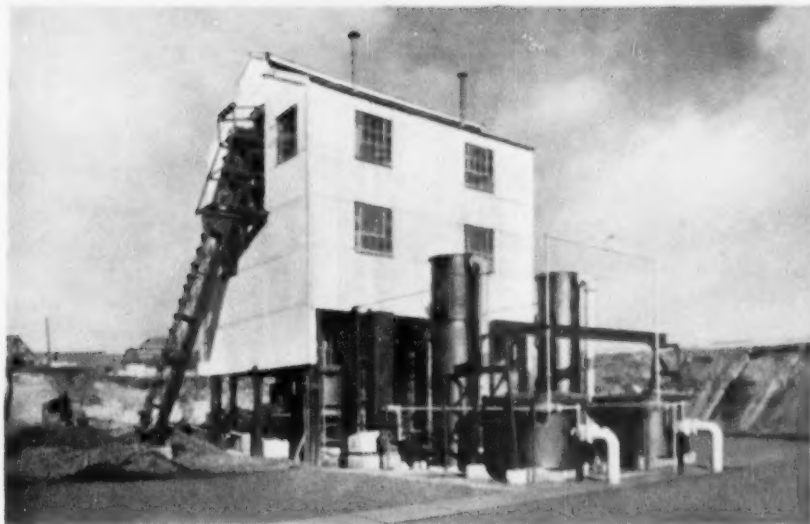
(Right) View of entrance end of kiln, showing hydraulic pusher, electric truck and dryer exit



(Left) Truck of fired specials being drawn from kiln by electric winch

(Right) Fired trucks being unloaded on to a rubber belt conveyor





Twin gas producer installation with elevator and washing equipment

are electrically driven and fitted with powerful winch gear for moving trucks into and out of dryer and kiln. Trucks are moved along the four tracks by means of twin cable haulage gears, the provision of complete mechanical handling making it possible to work the dryer and kiln with one operator only.

Dryer Details

The dryer is 160 feet long, giving a drying cycle of 84 hours. It is worked entirely with clean hot air recuperated from the kiln cooling zone. The provision of a recirculating circuit fitted with a fan handling moist exhaust air ensures a very satisfactory control of the temperature — humidity cycle. Goods leave the dryer in a completely dry state at 100° C., and are transferred without loss of time to the entrance air lock of the kiln which is maintained hot by recirculation of hot air from the cooling zone. This air lock is isolated from the kiln tunnel during transferring of trucks by means of a flexible roller shutter, in order to avoid loss of kiln draught while the kiln door is open.

In order to ensure complete combustion of the high percentage of carbonaceous matter in the fireclay, the kiln is worked with a very extended preheating period from 900° C. to

1,000° C.; the atmosphere being maintained very highly oxidising throughout the entire length of the kiln. A battery of 30 burners is fitted to the kiln, all supplied with washed coke producer gas from a fully-duplicated Gibbons-Heurtey producer plant. These producers are of the self steaming type, fitted with coke elevator, conveyor and bunker gear.

Heat Distribution

Hot air for the burner system is supplied under pressure from a fan drawing air directly from the kiln cooling tunnel and further preheating this air by passing it behind a heating panel set in the rapid cooling zone.

Two sets of Phillips high temperature recirculators with heat resisting alloy fans and aluminised ducts ensure good heat distribution in the preheating zone, in the 450° C. to 650° C. region.

The main zone is constructed in 95 per cent. silica brick and designed for a temperature of 1,500° C. if ever required. Provision has also been made for firing with liquid fuel, if desired, at a later date.

The goods are fired to Seger Cone 12, on a 157 hour cycle, and the uniformity of firing is remarkably good for all sizes and types of specials. Although only manually controlled,



Side view of tunnel kiln, showing gas main and burner system

the kiln runs with perfect consistency and requires but little attention. Burnt losses from all causes run regularly at $\frac{1}{2}$ per cent. and fuel consumption is a consistent 33 to 34 tons of coke per week.

Cooling

Cooling of the goods takes place in 38 hours, and is carried out in a cavity panel section, the tunnel of which is supplied with cold air by a large fan. Hot air for the dryer is tapped off from the cooling zone and the cavity walls, passed over the main arch of

the kiln and blown to the dryer. The cooling zone of the kiln is so efficient that the goods come out at little more than atmospheric temperature, and can be handled immediately.

An interesting feature is the provision of a spacious under car tunnel 95 ft. long under the high temperature section of the kiln, primarily for use in the event of movement of truck load and this is particularly useful for checking behaviour of truck running gear at maximum temperature, condition of sand seal, and other vital points.

DEATH OF MR. A. HEATH

WE regret to record the death of Mr. Arthur Heath, who has given a lifetime's service to the pottery industry and, since 1939, has been a ceramic consultant.

Mr. Heath, who was 87, was taken ill four months ago when engaged on a consultation at Arklow, Eire.

He began his pottery career as a boy at Ashworth's Pottery, Broad Street, Hanley, and, when a young man, was appointed a manager of the china department at the Royal Crown Derby Porcelain Co. Ltd.,

Derby. He returned to Stoke-on-Trent in 1897 on obtaining a similar appointment at Wedgwood's Works, Etruria.

In 1908 Mr. Heath was appointed agent to Casserata, Newark-on-Trent, a position he retained until the beginning of the last war.

Mr. Heath was one of the founder members of the British Ceramic Society and was President in 1930.

He leaves one daughter, Miss Florence Heath.

British Ceramic Society Jubilee: Provisional Programme

*Stoke-on-Trent and Buxton, 25th to 27th
April, 1950*

THE Society appreciates very highly the honour of being accorded a civic reception by the Lord Mayor and Corporation of Stoke-on-Trent at the opening of its Celebration. The Society is also considerably indebted to the British Pottery Manufacturers' Federation for providing an exhibition of pottery which can be seen during the course of the meetings. For visiting members the main provision for seeing the Exhibition will be on Tuesday afternoon, 25th April, but the Exhibition will also be available for inspection on Wednesday, 26th April. The Society is further very much indebted to a number of manufacturers of pottery, refractory and heavy clay goods for permission to visit their works. A brochure of the Jubilee Meetings will be issued to all those taking part.

The following is the Provisional Programme:—

Monday, 24th April

Visiting members arrive at Palace Hotel, Buxton.

Tuesday, 25th April

9.0 a.m. Buses leave Buxton for Stoke-on-Trent.

10.30 a.m. Reception by the Lord Mayor of Stoke-on-Trent.

11.00 a.m. Opening Address.

12.30 p.m. Lunch in the King's Hall at the invitation of the Lord Mayor and Corporation of the City.

2.30 p.m. Visit Exhibition of Pottery in the Victoria Hall.

4.30 p.m. Buxton residents depart for Buxton.

6.00 p.m. Stoke residents depart for Buxton.

7.30 p.m. President's Dinner at the Palace Hotel, Buxton.

9.30 p.m. Dancing.

11.45 p.m. Buses return to Stoke-on-Trent.

(Ladies may prefer to leave Buxton at 9.30 a.m. and arrive at Stoke by another route at 12 noon, afterwards joining in the main programme.)

Wednesday, 26th April

Refractory and Building Materials Sections.

8.30 a.m. Leave Buxton for visits to various works.

1.15 p.m. Lunch at Palace Hotel, Buxton.

2.15 p.m. Meetings of the Refractory and Building Materials Section Councils.

2.30 p.m. Meetings of the two Sections in which papers describing certain aspects of progress in the manufacture of firebricks, silica bricks, and heavy clay products and in the utilisation of fuel in these industries will be presented and discussed.

4.45 p.m. Conclusion of meetings.

5.45 p.m. Leave Buxton for Stoke-on-Trent.

Pottery Section.

10.30 a.m. Pottery Exhibition.

2.15 p.m. Meeting of Pottery Section in Stoke-on-Trent when papers dealing with progress in certain sections of the Pottery Industry will be presented and discussed.

4.30 p.m. Conclusion of meeting.

Ladies.

The morning is being left free.

2.15 p.m. Excursion to Haddon Hall.

5.45 p.m. Leave for Stoke-on-Trent.

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General

7.15 p.m. Jubilee Dinner in the King's Hall, Stoke-on-Trent.
10.45 p.m. Buses depart for Buxton.

Thursday, 27th April

9.00 a.m. Leave Buxton to visit various Potteries in Stoke-on-Trent.
12.30 p.m. Lunch in the North Stafford Hotel.
2.15 p.m. General Meeting of the Society. Subject: Education in the Ceramic Industries.
4.30 p.m. Conclusion of meeting.
(An alternative afternoon for the ladies will be provided.)

WORKS VISITS

The following manufacturers of refractories and heavy clay products have kindly offered to show a group of visitors round their works. Thanks are also due to the British Thompson Houston Co., for a similar favour.

Refractory Materials

Thomas Marshall and Co. Ltd., Sheffield.
General Refractories Ltd., Worksop.
Oughtibridge Silica Firebrick Co. Ltd., Oughtibridge, nr. Sheffield.

Heavy Clay Products

Ensor and Co. Ltd., Woodville, Burton-on-Trent.
Berry Hill Brickworks Ltd., Stoke-on-Trent.
G. H. Downing and Co. Ltd., Chesterton, Staffs.

Sanitary Fireclay Products

John Slater (Stoke) Ltd., Stoke-on-Trent.

Glass Works

British Thompson Houston Co. Ltd., Chesterfield.

The following manufacturers of table ware and wall tiles in the Potteries district have kindly offered to show a small group of visitors round their works

Table Wares

T. C. Wild and Sons Ltd.
Doulton and Co. Ltd.
W. T. Copeland and Sons Ltd., Minton Ltd.
Josiah Wedgwood and Sons Ltd.
Shelleys Potteries Ltd.

Wall Tiles

H. and R. Johnson Ltd.
Richards Tiles Ltd.

TESTING ADHESION IN GLASS-METAL SEALS

DURING the last ten years there has been an increasing demand for electrical components to be manufactured incorporating the use of glass-to-metal seals. Such equipment includes the modern radio valves, cathode ray tubes, and several types of high-vacuum equipment. During this development period, glass manufacturers produced several new types of glass, many of which revealed peculiar properties on sealing to metals of the low-expansion type, such as "Fermico" and "Kovar." In order to determine the quality of the adhesion between any glass and a suitable alloy, the following simple and rapid test was devised:

A bead of the glass under investigation is welded on to a length of wire or rod of the metal with which it is desired a seal should be made. This test piece is now subjected to a tensile stress in any tensile testing machine. Application of the load causes elongation of the wire together with a reduction in cross-

sectional area. If the adhesion is poor, the glass-to-metal interfaces will separate and the bead will be free to slide along the wire; on the other hand, if the seal is good the bead will crack, and the fragmented particles will remain attached to the wire.

Although the test is only qualitative, additional conditions of test can be arranged to simulate conditions known to exist in the component during use. For example, the test can be carried out with current flowing through the wire, or by maintaining the assembly at an elevated temperature.

(*Metal Progress*, March, 1950.)

Arc Welding.—As from 1st April all sales and service for "Unionmelt" automatic arc welding equipment in the United Kingdom will be handled by the Quasi-Arc Co. Ltd., and enquiries should be addressed to the company at Bilston, Staffs. (Telephone: Bilston 41905.)

Glass and the Future

By A. E. PAVLISH

Battelle Memorial Institute

A brief review of some of the things that have contributed to the glass industry's efficiency, increased production capacity and expanded markets.

THE glass industry is one of the few major industries which produces a basic product, utilised in some form or other, by people in all walks of life.

The size of the glass industry, compared with other industries, is surprisingly large. Glass production on a tonnage basis is as large as gypsum, aluminium, magnesium, copper, lead, zinc, plywood, synthetic rubber and plastics production combined. Of the non-metallic industries, only concrete, timber, and structural clay products tonnages exceed that of the glass industry.

Trends and changes in the industry by necessity are related intimately with (1) The development of new products and (2) The actual production of the glass. The importance of new products to the growth and prosperity of the industry is self-evident. The latter item, however, is controlled by many factors which contributed to the efficient production of saleable ware. The melting of the glass for example, which is of prime importance, is influenced by refractories, fuels and raw materials.

Refractories

The efficiency of the glass melting operations has improved markedly in recent years and, in many cases, about twice the pull on glass melting tanks is being obtained compared with that of a few years ago; some tanks are in operation in the U.S.A., with pulls of about four times the 1940 rates.

The quality and productivity of modern glass-furnacing operations are affected directly by the refractories

available for the operation. In the case of the large production continuous tank units, a definite trend toward the use of superior refractories has permitted an increase in the productive capacity without marked sacrifice in quality and in most cases, with an increase in the quality of the glass produced. The use of super refractories in continuous glass melting tanks permits higher operating temperatures and, therefore, higher productivity. The use of fused cast refractories for certain parts of the tank furnace has made possible considerably improved operating efficiencies.

The various branches of the glass industry are interested in the development of superior refractories which will permit the production of a quality glass at reasonable costs per unit of production. Fused cast refractories have been developed which contain appreciable amounts of chromium and which do not appear to contaminate the glass significantly during melting. This opens up an interesting field for future refractory development. Improved silica brick is another example of an improved refractory. The improved silica brick has found wide acceptance in the steel industry, and, even although the capital investment is greater, the unit cost per ton of steel produced is lower, owing to its increased life and service.

Glass Melting Pots

Research and development work on refractory pots for glass melting, both in America and in England, has led to some improvement in this product. The Molochite pot that has been developed in England; the cast pots produced at the American Bureau of Standards, and other developments should be leased to a refractory glass melting pot which will permit the production of glass of higher quality.

Fundamental research, leading to a thorough understanding of the corrosion of refractories by glass, is essential to

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the future development of improved materials for use in this operation. Once a basic understanding is obtained of the process of corrosion, as related to the composition of the refractory and of the glass, development of superior glass refractories should follow rapidly. This basic knowledge can best be supplied by the co-operative effort of the refractory and glass industries.

Raw Materials

The primary raw materials required by the glass industry generally, are available in large quantities, but the industry is not the major consumer of many items. The basic raw material requirements often are integral factors in the choice of the actual location of the glass plant (this would apply more to the U.S. than to this country). The quality of glass produced, in many cases, reflects quality of the raw materials, and the glass industry is striving constantly for a general improvement of quality.

Possible Cheap Sources

A simple raw material, such as sand, although widely distributed, contains appreciable amounts of impurities which are undesirable in the production of high-quality ware. For example, sand often contains many minerals other than quartz, a few of which, such as rutile and the iron minerals, are detrimental to the production of a good-quality product.

Increased beneficiation by physical means of some of the natural raw materials may be necessary to obtain a product of the desired quality. Individual plants, whether they be machine operated or hand plants, have their own specifications for raw materials, but co-operative endeavour by the plants might provide beneficial improvements in raw materials. Increased consideration has been given and presumably will be given in the future to the possible utilisation of cheap sources of raw materials which can be beneficiated for use in glass production.

For example, iron blast furnace slag which is now used in the production of amber glass, can be beneficiated at the producing plant or in the glass batch to permit its use in the production of glass other than amber. The consideration of more economical materials from the standpoint of actual cost per ton of

glass is of prime importance to the glass industry to permit the industry to maintain its competitive position.

Glass Melting

Considerable interest has been aroused in the possibility of utilising electric melting for the production of glass. Electric melting as an auxiliary fuel, found widespread use in foreign countries during the late war as one means of increasing the production of glass as well as overcoming difficulties with fuels that were used prior to the outbreak of the war.

In France, the Compagnie de Saint Gobain operated about 70 plants utilising electric glass melting systems. In all of these cases, the conventional glass-melting equipment was adapted to electric melting, and the production rate was reported to have increased appreciably; in some cases increases in production as much as 100 per cent. were reported. In the U.S. electric melting operations were comparatively uncommon until recently, and generally were located near sources of cheap electric power. Recent trends, however, indicate that electric melting may be used for the specific objective of producing desirable glass at high rates.

Development work along these lines has progressed rapidly, and results indicate that glass can be produced in some cases, about five times as fast as with conventional fuel melting. This high rate of production may offset the higher cost of electric power in some areas in order to gain other advantages from a production standpoint.

The wide interest in the general subject of melting and its relation to the production and quality of glass should result in the development of improved melting techniques. The increased rates of production which have been obtained within the past few years have been the result of the combined effects of improved refractories and "know how," which have permitted the operation of tanks at higher temperatures. A trend toward the development of melting units along more functional lines for specific jobs has been indicated in the recent technical literature and this is an approach that will bear watching.

Somewhat radical departures from normal practice might be a step in the

right direction. As an example, a foreign plant reputedly melted glass electrically in a large tank, and this glass then was fed into a number of separate chambers in which Gload elements were used for fining and homogenising. Various colours reputedly could be produced by making the necessary additions in the separate fining chambers. A scheme of this type might permit operation at extremely high rates with a minimum number of melting tanks, but with a large number of fining tanks. A trend away from pot melting by the quality hand producers is taking place. Day tanks are becoming quite common in many of the U.S. hand glassworks.

Automatic Control

The advances made in the fields of instrumentation and automatic control are being employed to improve the efficiency and economy of glass-melting and glass-working operations. The more refined types of automatic control, such as the proportional control are replacing the simple on-off systems and are making control operations easier and more precise. The use of automatic feeder temperature control has resulted in increased machine speeds and more constant gob weight. Automatic tank pressure and combustion air intake control provide more uniform combustion.

Economical operation is aided by control of the furnace fuel input and the furnace operation can be evened out, with resultant fuel savings and increased refractory life, by the use of automatic time reversal controls. More widespread use of such control systems and introduction of furnace temperature and glass level control systems in the future will aid further the production of glass.

Metallurgy

The glass industry has availed itself of new metallurgical developments. More widespread use is being made of special alloy metals which will withstand higher temperatures than cast iron, which has been widely used in the industry in the past. The use of these more heat-resistant alloys has permitted the production of specific items which could not be produced otherwise. Alloy mould materials covered with a chrom-

ium plate particularly have been effective in this respect. The chromium plate, when properly applied, enhances the surface characteristics of the pressed object in addition to providing the desired and necessary life during the operation. In the course of the development of this process, the method of treating the pieces to be plated and the techniques in plating had a marked bearing on the quality of the plated product.

Fuel

Fuel is one of the most important basic commodities utilised by the glass industry. Changes in the fuel employed have altered markedly the trends in the industry and have contributed to its enormous growth. Since the early days of glass making, when wood was used as a fuel, the location of the industry and its general movement followed the changes in the fuels used in the production of glass. Fuel still plays a dominant role and is one of the critical materials which must be considered in any long range development of the industry. This general subject has been discussed widely in the last few years owing to the limited potential lifetime reserves of some of the fuels. Coal, oil and electric power are available to the industry at the present time. Gas is a most desirable fuel to use in the production of glass, but the reserves available of manufactured gas are limited; moreover, the large and varied demands for gas by other industries and for domestic purposes are factors which are disadvantageous and which must be considered when evaluating gas as a fuel. The shift from coal to oil or gas as primary sources of energy, a trend which has been in process for decades, has been accelerated in recent years. The desirability of liquid or gaseous fuels is obvious in the production of glass by present methods of processing.

The general price of fuels has advanced in line with the upward movement of the general price level, but the structure of fuel prices has undergone substantial change and presumably, such changes will continue in the future. The desirability of oil and gas as sources of energy, as well as rapid developments in equipment to burn these fuels, has contributed to their substantial growth in recent years.

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Use of Coal

The most striking change in fuel technology during the past three decades has been the marked decline in the relative importance of coal as a source of energy and the increase in oil, gas and water power. The trends in the use of fuels in the glass industry and in industry generally, are not compatible with the proved reserves of the various fuels.

In some respects, it would appear that the glass industry is in about the same position with respect to fuel at the present time as it was at the time when it utilised wood as a fuel. The supply of wood continually decreased and ceased to be an essential fuel from the standpoint of the future of the industry. The coal reserves are for all practical purposes unlimited, whereas the other fuels which are being utilised, have definite limitations so far as the future of the industry goes.

For this reason, coal is likely to be more economical in long-range development of the glass industry. The present methods of producing glass do not permit the direct utilisation of coal as a source of energy. Methods of utilising this fuel indirectly, such as in the development of electrical energy, or conversion to a gaseous fuel, appear to be trends to be considered in the future of the industry. The efficient utilisation of this basic fuel may be tied up closely with the development of superior gasifying equipment or in the development of glass melting units which can utilise electrical energy produced from coal or water power. The location of glass plants will be determined to a large degree by the consideration of these future trends. Atomic energy as a fuel has been discussed as a potential source of energy, but it is doubtful if this will be generally available for years to come.

Uses of Glass

The forward progress of the glass industry has tended toward the use of glass along functional lines. The increased container production established during the war has maintained itself to a definite extent, and the importance of flat-glass in the overall picture of the glass industry is obvious. The increased use of plate glass in modern living, such as in the improved motor

cars of today, and in the residential buildings, has had a pronounced effect on this progress. These increased uses are largely a result of trends in thinking by designers and architects, and the industry itself should follow these trends, so as to establish this market on a broad basis for the future.

This trend utilises one of the functional qualities of glass which cannot be duplicated by any other material at a reasonable cost. Development programmes, such as the work being done on the fundamentals involved in the use of glass in solar housing, may contribute markedly to the advance and increased use of this material. The development and utilisation of glass fibres, photo-sensitive glass, tempered glass, laminated glass, outlets in television, sealed-beam headlights, etc., have all been made possible by a large amount of fundamental and engineering development work. Functional design has been adopted by the glass makers and has resulted in establishing the position of glass for specific uses. For example, one-way beer bottles, square milk bottles, etc., all tend to permit of the greater utilisation of glass. The container industry during the war gained a marked advantage owing to the shortage of other container materials, and by the proper development work, it should maintain this advantage.

Short-lived Gains

With the possible exception of the beverage industry, the gains in the container industry will be short-lived unless serious attempts are made to maintain glass in its proper perspective. Proper packaging of the container is an important factor in maintaining the position of glass in the container industry.

The majority of the patents and other published literature during the past year has been concerned primarily with the development of optical glass compositions, having specific properties, the development of coatings for glass and the production of glasses having specific transmission characteristics.

A fair number of research contributions were made during the past year, especially with regard to utilising various tools such as the electron microscope in obtaining a better understanding of glass.

The Scottish Ceramic Industry

OUR SCOTTISH REPORTER

THE Glasgow and West of Scotland Ceramic Artists' Club recently held a successful three-day show in Glasgow. This exhibition shows the organisation to be a potentially important force; it might not be too much to claim that it revives, after nearly a century, the art of ceramic decoration to a place in Scottish industry and art. The majority of members are either artists or craft workers, although few if any live entirely from their ceramic work. There is, however, a move in this part of Scotland to gather experience of methods and practice, and to build up a solid background of design.

No Positive Design Trends

The bulk of the work undertaken by the club is overglaze decoration. Firing is by a central kiln, with a small group of members working in co-operation, while raw materials are mainly pottery rejects, although potters who are members produce their own ware. No positive design trends are indicated, and there is no suggestion of a "Scottish" sentiment in design beyond a certain volume of Celtic motif work by some of the artists.

The outcome of this exhibition and the growing importance of the club are shown by the fact that a number of their ceramic artists now offer the commercial industry a source of potential material, if and when such material is wanted, and that in time many of the artists will develop the required technical skill and form a nucleus of technicians, capable of producing quality work.

A considerable volume of sales have resulted, showing that a market exists for art pottery, and it is the intention of the club to continue expanding production and scope, as facilities and interest permit.

It is suggested that the commercial industry in Scotland might well devise some system whereby such skill as may be developed could be used, on a commission or part-time basis, to expand the output of decorated ware. Admitting the difficulties involved, the talent shown here might well be used to advantage in industry.

GIFT TRADE POTTERY

Some further ventures have been launched in Scotland recently to meet the demand for good quality table ware for the gift trade. There is a strong feeling that Scottish tourist gifts should be made in Scotland and this encourages the establishment of small artist-potter shops wherever a craftsman sees an opening. Most anticipate that the output they can produce and their volume of sales will be small, and few anticipate expanding on to large scale mass-production work. One interesting example of such a unit is that established recently in Glasgow, by Mr. Sinclair Thomson, who not only produces pottery but built his own kiln and wheel.

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A view of the glazing department

Making Fireclay Ware in the Vaal Valley

by

Colonel W. R. GORDON, O.B.E., M.I.I.A.

Exclusive in Great Britain to CERAMICS

IN a country such as South Africa there can still be found romance in the growth of private enterprise. Seven years ago the Meyerton factory of Vaal Potteries Ltd. was not in existence. Indeed, it was scarcely even envisaged. Yet, today it employs sixty Europeans and 220 Natives, for the moulding and firing of over 6,000 large sanitary ware articles, plus smaller commodities and accessories, per month.

Back in 1943 production began on "dumpy" jars as containers for tooth powder and similar products. Of the

£15,000 nominal capital only £3,000 was paid up. The total manufacturing plant consisted of one small kiln and a shed. Even the very land upon which the enterprise stood had been bought through the good grace of a building society.

But, gradually, the range of products was extended. Besides the original "dumpy" jars there came forth belly-shaped mugs for Army canteens. Both were useful, but certainly not classical in design. Then a new kiln was erected. The production of pottery began in real earnest

○
Sink and
urinal
casting



and large numbers of cups, saucers, cheese dishes and the like were manufactured both for the Union and the overseas markets. This crockery was sold as far afield as Singapore. From the original figure the staff employed rose from two Europeans and eight Natives in the earliest stages to five European men, fifty to sixty European girls and thirty to forty Natives around 1946 and the following year, when all types of crockery were still in exceedingly short supply.

While the company was doing its best to meet a large and then unsatisfied demand, the Board was farsighted enough to realise that, for the establishment of a permanent industry, crockery was not ideal. In the first

place the clay available was not really suitable for the finest products of that type, secondly money for research was unlikely to be forthcoming, and, finally, taking a realistic view, English pottery was beyond comparison better than anything which the company might immediately be able to turn out. Once imports from abroad were again entering the Union, the market for the local product would dry up, despite the fact that what was then being made could not even meet the needs of the moment.

Switch to Sanitary Ware

The decision was, therefore, made to embark upon the manufacture of sanitary ware. Accordingly, in



○
Basin
casting
department

CERAMICS

December, 1946, Pottery and Fireclay Industries Ltd. was floated, with an authorised capital of £300,000, to provide the necessary resources enabling the company to switch over from the production of crockery to that of the sanitary ware, which they are producing so successfully today. The next step was to import further technical men from Britain and, under these, a number of apprentices have been so well trained that they have now passed out of their time and can earn their living at their trade anywhere in the world. With this staff, products are now being manufactured at Meyerton which can compete favourably with imported articles of a similar type,

stall urinals, swimming bath scum channels, wash tubs, trough closets and tray urinals in a variety of sizes, designs and with fittings of several different shapes. Although the trough closets and tray urinals may be peculiar to the local market only, they are being made to meet the large and growing demand from mines, factories, municipalities and the Union Public Works Department. Part of the firm's range of products is being exported not only to the Rhodesias but also to the East Coast of Africa as well. Manufacture is being conducted throughout according to the specifications of the British Standards Institute. The present policy of the company is



Water closet
casting
department

both on the score of quality and of price.

The company has clay mining rights over large areas, containing considerable clay deposits and situated only three miles from the factory itself. At the time of my visit there were 15,000 tons of clay on weathering floors at the clay pits. All the other raw materials, with the sole exception of tin oxide, which is used as a pacifier in making the opaque glaze, are obtained from sources within the Union.

Range of Products

The only concern of its kind in South Africa, the company is presently making basins, water closets, cisterns, sinks, pans, channels, treads, slabs,

showing its wisdom, for the material manufactured, namely white enamelled fireclay, though lacking the finer appearance of earthenware, is greatly to be preferred in Africa on account of its durability, its capacity to withstand rough usage and because of the wider range of goods that can be made from it.

On the marketing side, the company sells through the Industrial Utilities Corporation, which is a separate concern with a tie-up with the Union Metal Foundry, makers of high and low level cast-iron cisterns, sanitary pipes and manhole covers, as well as with the agents for the "Master-built" w.c. seats. Thus, their marketing organisation can offer the whole range of sanitary requisites. Pottery and

Fireclay Industries Ltd. are also on the approved list of manufacturers from whom the trade can buy. On the home market they can only sell to members of the South African Federated Sanitaryware Association. They cannot, for instance, sell to plumbers of builders direct. The company belongs to the Transvaal Clay Manufacturers' Association.

Raw Material Processing

All the raw materials are laboratory tested as they are received. They are then ground in edge runner pan mills, screened and stored in separate bins ready for use, each type of clay being processed independently. The pre-fired material consists of a certain percentage of "grog," mixed with a percentage of milled fireclay, which has been passed through a pug-mill. It is then mixed with sodium silicate and water, being run into moulds in liquid form.

In manufacturing, the company makes all the kiln setting furniture and refractories in its own works. The routine comprises, first, the mould making, carried out by four modellers using locally obtained plaster of paris. In the shaping process an entirely slipcast method is employed, using an alkaline casting slip. The mixing period for the clay is from four to six hours, while the casting time varies from two to six hours.

The casts are withdrawn from the moulds, hand-finished and fettled. The joining and sticking up is done by skilled European tradesmen with non-Europeans as labourers. The casts then pass through a dryer and sorter, where all the dust is removed with a large vacuum cleaner and where they are

scrutinised for faults. Due to the low humidity and the excellent drying properties of the climate, drying is mainly a natural process.

From the "green" state, engobe and glaze are applied to the casts by brush. Four coats of each are given. Distinctive stains are employed to distinguish the different coats. The drying of both glaze and engobe are, again, natural. Before application both are kept in a refrigerator at a temperature of 40° to 45° F. in a gelatinous state.

The ware is then placed in Scotch type muffled kilns at 1,280° C., the burning cycle being approximately one week. After firing, the ware is sorted, inspected and classified for faults. Fitted ware, such as slab or stall urinals, are trimmed with carborundum saws to merchants' specifications. All water-closet pans are flush tested, crated and despatched, mostly by rail from the nearby station.

Research

With the fireclay plant already established, the company has now set aside a laboratory for research into, and a pilot plant for the manufacture of sanitary earthenware and for vitreous china, both of which should be in production in the near future.

Considering that there are no specialised suppliers of raw materials in this country and no pool of expert labour, except that which the company has trained for itself, the achievement of this firm had been quite remarkable. Seeing the busy, well-laid-out factory at Meyerton today, it is hard to believe that this industry has all been the result of only seven years' intensive effort.

DUST RECOVERY EQUIPMENT

A Specification

WE have received from the Power-Gas Co. Ltd., Stockton-on-Tees, more details of the above equipment, under the title, "Specification of P-G-Draco Dust and Fume Control and Recovery Equipment MB Type." Among samples of the dust and fumes being handled by existing installations are: Bauxite dust, borax, carbon black, cement dust, chalk dust, charcoal dust, clay dust, coal dust, coke dust, dolomite dust, glass plant dust, grinding wheel dust, gypsum dust, lime dust, limestone dust, plaster paris dust.

The specification describes in detail the fully automatic and semi-automatic plants, together with the ancillary equipment. Details are given of the filtering area, the headroom, etc., and there are diagrammatic sketches illustrating the means of operation. This specification may be obtained by application to the company.

Change of Address.—Megator Pumps and Compressors Ltd., have now moved their offices and showrooms from Feltham to 43 Berkeley Square, London, W.1.

Automatic Temperature Control in Pottery Drying

by

LEO WALTER, A.M.I.Mech.E., M.Inst.F., A.M.H.V.E., M.S.I.T.

EFFICIENT drying of pottery goods before firing is an instance, where the application of automatic temperature control is advisable. In many cases, the stoves are heated by means of steam coils, and when improvements are attempted, the first thing to look after are the steam traps, and to make sure that the heating coils have a proper fall from inlet of condensate to outlet. Three typical examples are given where correct trapping and application of temperature regulators is recommendable.

Fig. 1 shows a commonly used pottery drying stove with shelves. In this example, the bricklined stove

measures about 12 ft. long \times 6 ft. wide \times 8 ft. high, having wooden shelves along both sides and at the back. The steamheated gilled coils are placed on the floor underneath the shelves, and the heated air is allowed to flow upwards and out of a vertical air exhaust duct on the roof. The temperature required varies somewhere between 100° and 130° F. according to nature of goods to be dried. The illustration shows a self-actuated temperature regulator with steam control valve fitted in the steam inlet in a by-pass, with isolating valves. The thermostat bulb is located across the vent in the roof of the stove, and reacts to exhaust air

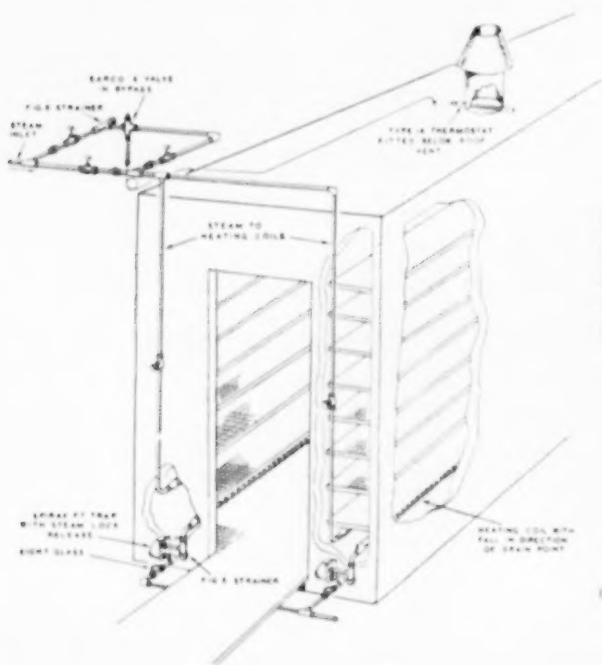


Fig. 1. Automatic steam control and condensate draining equipment on steam heated pottery drying stove

(Courtesy: Sarco Thermostats Ltd.)

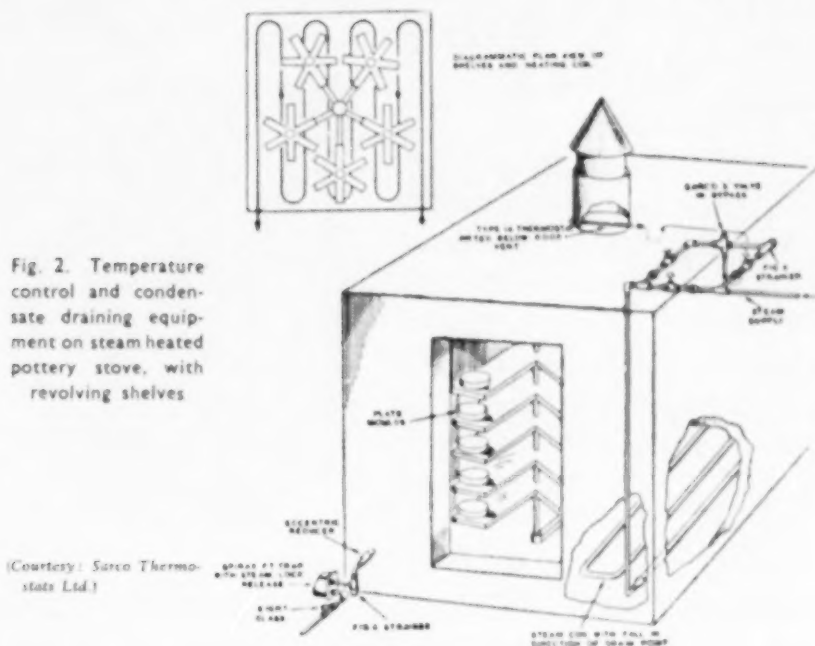


Fig. 2. Temperature control and condensate draining equipment on steam heated pottery stove, with revolving shelves

(Courtesy: Sarco Thermostats Ltd.)

temperature by throttling, or admitting more steam flow, according to stove temperature.

Steam control of another very common type of pottery drying stove is similarly performed, as shown in Fig. 2. Six revolving shelves are used, and in the older types heating is performed by means of steam coils near the floor as shown. Much steam can be wasted by allowing temperature to rise over the necessary maximum temperature in the stove, and hand control of the steam supply valve should preferably be replaced by thermostatic control.

A more modern type of pottery dryer utilises air circulation and recirculation by means of an electrically driven fan, as illustrated in Fig. 3. The heater battery, which can be heated by means of steam or hot water, or in some instances by gas, is usually located on the roof of the stove, and a more scientific air distribution is used. The outgoing air is drawn off through a longitudinal slot near the floor of the stove, and the hot air inlet comes from a slot at the opposite side near the roof. This produces a vertical vigorous flow of

the hot air downwards, and ensures good distribution of the air avoiding cold spots. The most important feature of this design is, however, application of recirculation of the air. This is performed by admixing part of the humid warm exhaust air to the incoming fresh air, which has the double advantage, to warm up the outside air, and to moisten it, when necessary to avoid too sharp drying (which would cause surface hardening of the goods).

A recirculating air damper is shown which should be very carefully adjusted by hand, following the indication of a wet and dry bulb hygrometer. A self-actuated temperature regulator is shown for temperature control, and two possible positions of the thermostat bulb are illustrated: (a) in the outlet air duct, where the thermostat can react to the varying load of the oven or, (b) in the inlet air duct where the thermostat produces supply of hot air at a constant temperature. This latter arrangement may be necessary if distribution of the hot air entering the stove is such that it might adversely affect the goods nearest to the hot air inlet, which

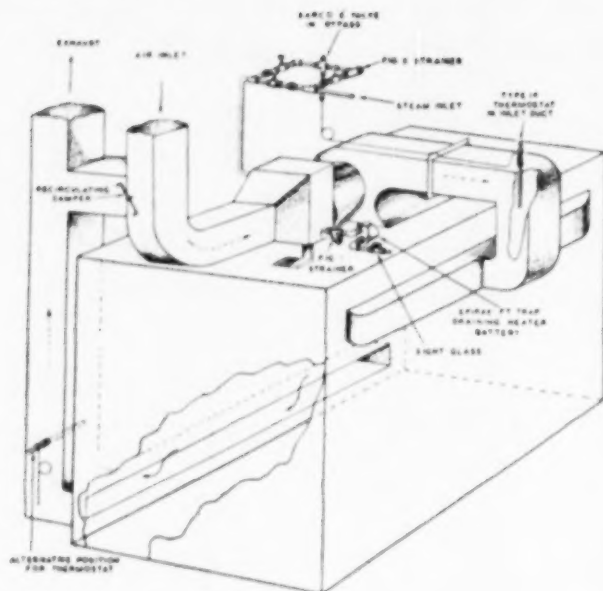


Fig. 3. Pottery drying stove, with hot air circulating system

(Courtesy: Sarco Thermostats Ltd.)

could occur with arrangement (a), whereby at high heat load the thermostat would allow higher inlet air temperature than would be advisable.

Temperature and Humidity Control

It is possible, of course, to apply combined automatic temperature and humidity control to modern hot air dryers in potteries whereby a suitable control instrument, usually of the pneumatically operated type, automatically adjusts heat input and position of the recirculation air damper. Special air damper motors are available for the latter, and

efficient pneumatic recorder - controllers can be applied, where the design of the stove and nature of goods warrant higher expenditure on installation.

Many an old-fashioned pottery drying stove could be improved in efficiency regarding heat consumption and output, if more scientific drying methods would be applied, embracing recirculation of air and automatic control. Often installation of one or more fans with adequate inlet and outlet air ducts can make all the difference between a mediocre stove operation, and an efficient stove operation in potteries.

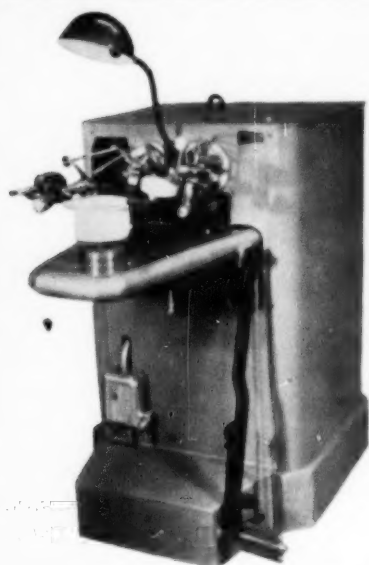
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This is an Arrow Press Publication. Published Monthly.

Subscription Rate 25s. per annum.

*Published by Arrow Press Ltd. at 29, Grove Road, Leighton Buzzard, Beds
Telegrams: Gastymes, Leighton Buzzard. Telephone: Leighton Buzzard 2328/9*

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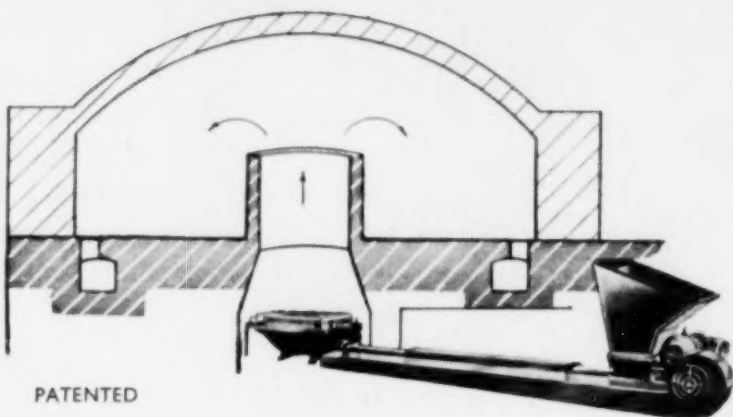
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